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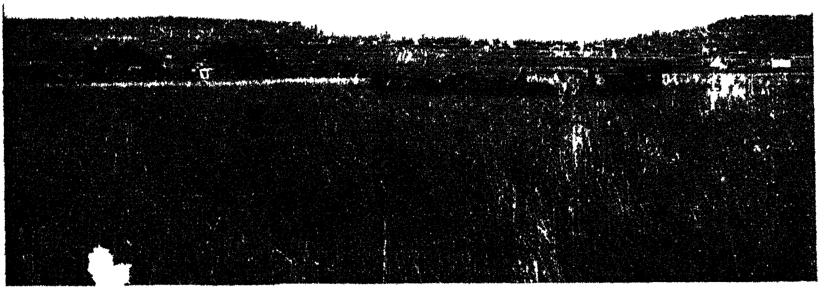

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Event and Comment.

Th bacco Industry in the North.

R ERRING to a proposal that the State Government should take over the Tobacco Experiment Farm at Mareeba, which was established some years ago by the Commonwealth Government, which i now abandoning the project, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, informed the Press recently that he could not agree to such a proposal. The Commonwealth Experiment Farm at Mareeba ha no doubt, fulfilled its purpose up to a point. The Commonwealth Go ernment, however, had not given his Department any details of its w results, or policy at Mareeba. He had no figures indicating its cost upkeep, nor had any other essential information been made available to his Department. In the circumstances, Mr. Bulcock said, to take over the farm would be literally buying "a pig in a poke." Moreover, if acquired, the expense of its maintenance would lead inevitably to a limitation of the more practical and diversified form of research already instituted by the Department of Agriculture, and which alone could produce the detailed knowledge of soil, climatic, and other conditions affecting the tobacco crop, and of which growers were urgent need.

Far from neglecting the tobacco industry in the North, the Minister added, the Government had considerably strengthened its instructional staff in that division at the expense of other agricultural industries. At the present time there were altogether five field officers at Mareeba and Dimbulah, engaged solely on instructional and experimentation work associated with the tobacco-growing industry. In addition, the services of local officers of the Entomological and Pathological staff had been made available to the tobacco growers in those districts. The extension of the work of his Department along the lines already planned would yield information of greater value to the tobacco growers generally than could be expected from a continuance by the State of the Federal Tobacco Experiment Farm at Mareeba.

Experiment Plot System Organised.

PAST experience with tobacco and other agricultural crops, continued Mr. Bulcock, had shown that experiment work, as distinct from purely research work, to be of the maximum practical value to growers as a whole must be designed to embrace all of the soil types and variations of climate and locality associated with production of commercial crops. For that reason, his Department had adopted a policy of replacing experiment farms with a well-organised system of experiment plots throughout a particular district. In the last two years most of the money available for agricultural experiment had been applied, almost exclusively, to the development and extension of the tobacco experiment plots for the purpose of assisting the grower in the most practical way. Previously that work had been confined to a few small, scattered, exploratory plots varying in area from a quarter of an acre to an acre, and situated in widely separated parts of the State. Tobacco experiment work in the far North was limited to one locality alone—Mareeba. Under the present Government sixty local experiment plots had been established with a range of trials covering plant classification, propagation, crop rotation, and fertilization, as well as varietal tests. Of that number thirty-nine were situated in the far North, including twenty-two in the Cairns district. From these more up-to-date methods, information of immense practical value to growers, had been made available in every locality so served.

The additional Commonwealth grant of £1,250, which it had been claimed should be used by the State for carrying on the Mareeba Tobacco Farm, and which would otherwise permit of an extension of the more practical Departmental scheme, was not given for investigatory work in one particular locality, but in the State as a whole. To curtail the practical field work of his Department, which was of benefit to every grower in the North, as well as in other parts of the State, merely to enable a purely local experiment station to be carried on, could not be justified on the facts, financial or otherwise. Having regard for the wide variation in soil types and every other controlling factor, the continuance of such a station could only benefit a few local growers farming country similar to that on which the station was established. In any case, equally valuable information could be gained by the more practical plot system by all the growers concerned, including, of course, those farming in the immediate vicinity of the station.

The General Position of the Tobacco Industry.

MR. BULCOCK added that he was deeply concerned with the position of the tobacco growers in the North, as well as in other parts of the State. Everything that could be done by the State Government would be done to relieve the situation. Regarding the position of the tobacco industry generally, the present unsatisfactory position must be attributed largely to the reduction of duty on imported leaf and the increase in excise on home-grown leaf. In this respect North Queensland growers were not alone in their feeling of the effects of the present Federal fiscal policy.

In respect to the marketing of Mareeba leaf particularly, there had, apparently, been no fixed standards of buying, and the buyers had shown surprising inconsistency in their purchases. No definite information had, seemingly, been received by the growers from the manufacturers as to grades, quality, and quantity of leaf necessary to meet manufacturing requirements.

The fact remained, concluded Mr. Bulcock, that while a considerable quantity of usable Australian was left unsold—the best of it in some cases not even attracting a bid—the volume of imports showed little diminution. Up to approximately 17,000,000 lb. of foreign-grown leaf was imported into Australia last year. As the Australian consumption was about 20,000,000 lb., the margin in favour of the Australian producer was lamentably small.

Heavy Cane Crop in Prospect.

IN his preliminary estimate of the Queensland cane crop the director of the Bureau of Sugar Experiment Stations (Dr. H. W. Kerr) says the yield this year will be 4,516,000 tons of cane, as compared with the record tonnage of 1933, when 4,667,000 tons of cane were milled. Heavy tonnages of cane will be harvested in most mill areas again this year. The beneficial rains experienced in the Southern districts during the past growing season have resulted in the production of the heaviest crops recorded in those parts during the past ten years.

It is probable that the early forecast will be reduced considerably before the harvest is completed, due to the extraordinarily heavy flowering which is being experienced in all districts, he adds. Where the canes have "arrowed," no further growth will take place, and there is a possibility that much of the crop will be overmature before it is harvested. Early reports from those mills which have commenced crushing, and preliminary tests from other areas where harvesting has not yet begun, suggest that the cane is this year rich in sugar, in contrast to that of 1933. Allowing 7·1 tons of cane to produce 1 ton of sugar, the sugar yield on the above estimates will be 636,000 tons, as compared with an actual yield of 638,000 tons for 1933.

Farm Training Schools.

THREE farm training schools on similar lines to the establishment at St. Lucia, near Brisbane, may be opened in country districts in the near future. In making this announcement recently, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) added that it had been decided to make an inquiry as to suitable sites and that the investigation would cover the Central and Northern Divisions of the State; and that it was probable that a farm training school would be established at Kairi Experiment Farm on the Atherton Tableland.

Queensland Citrus Scale Insects and their Control.

By W. A. T. SUMMERVILLE, M.Sc., Assistant Entomologist.

(Continued from page 591, Volume XLI.)

SCALICIDES.

INSECTICIDES are classified, in accordance with the manner in which they affect the insect, in three groups—stomach poisons, fumigants, and contact insecticides.

As scale insects draw their food supply from beneath the surface of the plant the only method of administering a stomach poison would be by introducing it into the sap of the plant. Experiments with this object in view have been carried out in various countries, and in the course of the work on scale insects of citrus in Queensland a number of substances claimed to be effective in this way were tested. However, no success has so far been achieved here, and from the reaction of the plant to those substances which have been tried there does not appear to be much hope of success in obtaining a general distribution of any chemical throughout the plant by injecting it into any one part. From observations on the apparent resistance of particular trees to certain species of scale insects it appears possible, however, that if the correct material could be found and the plant made to absorb it in the same way as it ordinarily does its food, the sap might be rendered unsuitable for certain scale insects. This is mere theory, however, and as there is no known way of effectively polluting or altering the sap of citrus, the artificial control of scale insects must be accomplished by the use of fumigants and contact insecticides.

FUMIGANTS.

The only fumigant discussed in the control of citrus scale insects will be hydrocyanic acid gas, which can be produced in a number of different ways in the orchard.

Hydrocyanic Acid.

Since Coquillett, who was investigating the control of cottony cushion scale in California at the time, demonstrated the value of hydrocyanic acid gas as a scalicide and placed its use on a practical basis, this material has become more and more commonly used for such a purpose in many parts of the world, and is generally regarded as the most dependable lethal agent known for the control of insect pests. The acid and many of its derivatives are extremely poisonous, not only to most insects but to higher animals, and great care must be exercised in handling these substances to which the general name "cyanide" is applied. The fumigant has no significant ill effects on the tree provided certain conditions are observed, but if the limit of these conditions be exceeded the trees may be severely injured. In so far as orchardists are concerned there are two important physical properties of the gas. It is colourless, and its presence can therefore be detected only by the smell, which resembles that of bitter almonds, and it is lighter than air and therefore tends to rise and diffuses rapidly in ordinary atmospheres. The gas may be produced in the orchard by the reaction of

sulphuric acid or water on a derivative of hydrocyanic acid, or by the volatilization of liquified acid. These methods will be discussed separately under the headings of the chemical chiefly concerned.

Potassium Cyanide.

For many years all the hydrocyanic acid gas used in fumigating citrus trees was produced by the so-called "pot" system. This method has been largely displaced by other more convenient ones, but it is still used to a considerable extent in Queensland, and owing to increasing costs of the more recently introduced methods there are indications that the old "pot" method may again become the most commonly used.

With this method the required amount of water is placed in an earthenware jar and good commercial sulphuric acid, equivalent in volume to one-third of the water, is added. The jar is then placed in position under the sheet (see procedure lower down) and the required amount of potassium cyanide is dropped quickly into the jar. If the jar be shallow a piece of sacking placed over the mouth is useful to prevent spurting. The required amounts of chemicals are determined by reference to a table prepared for the purpose. (See Table II., page 22.) It is important that the correct amount of water be used. In all cases the proportion of water, acid, and cyanide is 3:1:1, where the amount of cyanide is expressed in ounces avoirdupois and the liquids in fluid ounces. If too little water be used the reaction may not go to completion, and if too much be present the amount of available gas is again reduced. If pure sulphuric acid be used the product may contain an appreciable amount of another gas which is very injurious to plants. In practice the potassium cyanide used is not pure, but is a mixture of potassium and sodium cyanide and a little inert matter. Generally a value of the article in terms of its equivalent to pure potassium cyanide is declared.

This method has a number of objectionable features. From the point of view of those doing the work it is both cumbersome and dangerous. The work must be done at night, and measuring the highly-corrosive sulphuric acid and handling the very poisonous potassium cyanide is very unpleasant work. From the point of view of the grower there is the extra cost of night work, the increased depreciation of equipment, and the lack of continuity of work commonly experienced on account of unsuitable atmospheric conditions.

The efficiency of hydrocyanic acid gas as a scalicide was shown by Knight[9] to be dependent on both the concentration and the length of time the insects are enveloped. That is to say, the smaller the amount of gas the longer it will need to remain to kill the insect. There is a definite minimum below which the gas is not lethal no matter how long it be present, and the upper limit of concentration is dictated by the reaction of the tree to the poison. When generated by the "pot" method the gas is hot and is evolved quickly, and thus diffusion is very rapid. In practice very rapid diffusion means rapid leakage, and thus concentration of the fumigant may be so quickly lowered that there is a considerable drop in efficiency. For this reason the "pot" method is not the most satisfactory way of producing the fumigant. An exception, however, appears to be provided in the case of pink wax, and the "pot" method has been found normally to give better results against

this species than the other systems in which the fumigant is evolved more slowly. It would seem that with pink wax the time factor is of less importance than with most other citrus scale insects.

Calcium Cyanide.

Fumigation by the use of calcium cyanide is the most commonly used method in Queensland at the present time. When calcium cyanide interacts with water hydrocyanic acid gas is produced. In citrus fumigation practice the calcium cyanide in a finely-divided state is brought into contact with the water vapour of the atmosphere. The rate at which the gas is evolved depends on the amount of water vapour present and the rate at which this can come in contact with the active material. The rate at which the water vapour can reach the material depends to a large extent on the surface area of the solid, and thus this rate will be increased as the size of the particles of the solid is diminished. The state of division of the material is therefore of importance. There are a number of forms of calcium cyanide marketed in Queensland, but only two proprietary lines are used to any extent in citrus fumigation. These are Cyanogas and Calcid Briquettes.

Cyanogas for citrus fumigation is manufactured in two forms—"A" Dust and Cyanogas G. The former is a finely-powdered material and the latter more granular. In theory the G grade should be the safer and better form for citrus fumigation, but growers generally prefer the "A" Dust. Provided attention is given to conditions the "A" Dust is perfectly satisfactory under Queensland conditions, and the only injury noted after extensive use of this material has been burning of lemon fruits when a good distribution of the dust was not obtained.

Calcid Briquettes represent a more recent method of citrus fumigation. This method has not yet been adopted to any great extent in this State, but it has much to commend it. In fact, in experimental fumigation work the best results obtained against all species of scales other than pink wax were obtained with this material.

In using calcium cyanide in either of the above forms, all that is necessary is to introduce the material under the tent and obtain as good a distribution as possible. In the case of Cyanogas the most commonly used method is to blow the dust under with a forge type blower, but owing to the cost of such a blower many growers throw the dust in by hand. The dust is placed in a shallow tray, such as a saucer, and thrown in with a sweeping motion. This is effective, but precautions must be taken to obtain a good distribution of the dust. If the dust be merely thrown in and allowed to fall in heaps, the risk of burning is considerable, and at the same time the probability of effective fumigation of the scale insects is appreciably lessened. The use of a blower is strongly recommended, but the hand method may be used provided the necessary care be taken. In the case of Calcid Briquettes it is essential to use a grinding machine, and for this purpose a specially-designed machine is obtainable. This grinds the briquettes finely and delivers the powder under the tent.

The methods of obtaining hydrocyanic gas by the use of calcium cyanide have much to commend them. No corrosive acid is employed; calcium cyanide, though poisonous, is much safer to handle than potassium cyanide; the work can be carried out in daylight under a

wide range of climatic conditions; and the whole operation is very simple. The manner of evolution of the gas is such that the leakage factor is definitely reduced, and in no case observed has severe burning been caused when correct precautions were taken. The results obtained against all species of scale are highly satisfactory, and, except in the case of pink wax, are superior to those obtained with the "pot" system.

Liquid Hydrocyanic Acid.

Since 1918 the use of liquid hydrocyanic acid has largely displaced all other methods in California. The liquified acid is drawn to a machine known as an applicator. This machine measures the dose and delivers the liquid under the tent through an atomising nozzle. On reaching the air the atomised liquid is immediately converted to the gaseous state. This method eliminates most of the objectionable features of the old "pot" system, both from the point of view of actual work and efficiency as a scalicide. Liquid hydrocyanic acid, however, has not yet been introduced into this State, and under present circumstances its introduction would scarcely be a commercial success. If, however, the difficulties of marketing it at a reasonable cost could be overcome, the liquid would almost certainly be the most satisfactory form in which to use the fumigant.

Possible Fumigation Injury.

Fumigation injury, or, as it is commonly termed by growers, "cyanide burn," is fairly distinctive in type but is occasionally mistaken for fungous trouble. Leaves may be merely spotted, or, particularly if tender, have an appearance very similar to frost burn. The injury to the twigs is similar. The trunk and main limbs are seldom damaged, but patches of dark dead bark sometimes appear when careless application causes calcium cyanide dust to lodge in a heap on the tree as it sometimes does in a fork. Such injury to woody parts is commonly followed by gumming. When the "pot" method is used, emptying vessels close to the butt of the tree may cause the death of bark and roots nearby.

On the fruit, fumigation injury is somewhat variable. The most common type is a pitting of the rind. These pits may surround a patch of dead tissue which imparts a scab-like appearance to the area. At other times, especially in the case of lemons, on the upper portions of the fruit, particularly those in contact with the sheet, there may be a brown or light-green area, which, if the fruit remain on the tree, turns to a somewhat bronze colour.

Badly injured leaves and fruit fall quickly, and very small fruits rarely survive the slightest injury. In cases of severe burning twigs may be killed back to the limit of hardened growth, whilst in the worst cases the dead tissue may extend a foot or more back from the tips.

CONTACT INSECTICIDES.

The following contact insecticides will be discussed in the succeeding paragraphs:—Oil sprays, lime sulphur, washing soda wash, soap and washing soda mixture, oil-soap-washing soda spray, and resin-soda-fish oil spray.

Oil Sprays.

The occurrence of varieties and species of scale insects resistant to hydrocyanic acid gas greatly stimulated research work on oil sprays in

the United States of America. As the result of the investigations carried out by de Ong,[10] Ralph H. Smith,[11] Woglum,[6] and others, there is now a fuller conception of the manner in which oil sprays act and a far better understanding of the essential properties of an effective and safe oil spray.

Kerosene emulsion may be regarded as the forerunner of the present day oil sprays. This material fulfilled one requirement in that it was reasonably effective. The emulsion, however, is rather difficult to prepare and gives very little margin of safety to the trees, and was displaced by the miscible oils.

Miscible oils are refined petroleum oils in which is dissolved a soap or some other such substance which enables the oil to be readily mixed with water to produce a stable emulsion. These miscible oils have been in use for a considerable period.

Following miscible oils another type of oil spray known as oil emulsion was produced. These oil emulsions are prepared by dissolving an emulsifier such as calcium or ammonium caseinate in water and adding the oil. When violently agitated the mixture breaks up into small globules and forms a stable emulsion.

In California a third type of oil spray is finding much favour and is now generally recommended. This is the so-called tank-mixture type. The pure oil is added to the water in the spray tank and an emulsifier, commonly powdered blood albumen spreader, is stirred in, and the whole then violently agitated. The agitation is a most important part of the preparation and must be maintained throughout the spraying. The greatest advantage of the tank-mixture spray is that growers are thus enabled to prepare an oil spray of known and definite properties. In practice two grades of oil are supplied, a light oil and a heavy one. By mixing these in various proportions a number of different grades may be produced in accordance with the requirements of the trees to be sprayed. The greatest drawback to this type of oil spray in so far as Queensland at present is concerned is that machines capable of moving a large-sized agitator at 200 revolutions per minute do not form part of the spraying outfit of any orchardist, and most machines in use would have to be discarded since that agitation is essential. This, however, would not prove an insuperable barrier in many cases, but the proprietary brands of oil sprays now available are for the most part so satisfactory that tank-mixture oils are not likely to be used to any extent in this State under present circumstances.

The greatest practical result of the research work mentioned above, in so far as Queensland is concerned, has been the production of the so-called white oils. These white oils represent a distinct advance on the old red miscible oils. The improvement is not so much in increased toxicity to the scale insect, for though some white oils are superior to any red oil certain red oils are definitely superior to many white ones in respect to toxic effect on the scale insect. The great advantage of the white oils is the increase in the safety of the trees, and in this particular the difference between the two is great, and much of the objection to the use of oils on citrus disappears when white oils are used.

The scalicidal value of an oil depends on both the efficiency of the material as a lethal agent on the pest and on its effects on the tree. These properties are governed largely by the purity of the oil, the

volatility of the oil, that is, the rate at which it will dry and evaporate, and the amount of the oil left on the tree after spraying. The purity of the oil depends on the extent to which unsaturated hydrocarbons are present. These unsaturated compounds, which are very poisonous to the plants, are removed from the crude oil by the use of sulphuric acid, and the purity of the oil is expressed in terms of the percentage which remains unchanged when treated with sulphuric acid. By modern processes oils can be highly refined without undue increase in cost, and this represents one of the most important advances made with respect to oil sprays. An oil, to be quite safe as a spray material under most conditions in Queensland, must be about 90 per cent. pure. Most of the white spraying oils marketed in Queensland fulfil this requirement. There are, however, a small number which are appreciably less purified, and though these may be employed under certain circumstances care must be taken to observe the conditions of use. Generally it has been found that the less pure oils must be used at considerably lower temperatures than would be quite safe for those fulfilling the condition given above.

The more volatile an oil the quicker it will evaporate, and as oils must remain on the insect for a certain length of time to cause death, too light an oil cannot be used for scalicidal purposes. However, when an oil spray remains on the plant it penetrates the tissues to some extent, and the longer it remains, within certain limits, the more oil there will be absorbed by the plant. A little oil may be absorbed without appreciable ill effect, and the more vigorous the plant the greater the amount which may be absorbed without prejudice to the health of the plant. In larger quantities, however, the absorbed oil may cause death to the part. Thus, though to effect a kill of the scale insect an oil must not be too light, it must not be so heavy that the plant is adversely affected. Under Queensland conditions the use of heavy-weight oils is fraught with danger.

When an oil spray lodges on the tree the emulsion is broken down and the oil and water separate. The rate at which this separation takes place depends to a large extent on the efficiency of the emulsifier. If the quantity of spray which falls on a leaf is not more than actually required to wet it, all the oil in that amount of spray will, of course, remain on the leaf. In actual spraying, however, in order to ensure that every part of the tree is covered, much of the tree will receive a great deal more spray than is actually necessary to wet it. As soon as, say a leaf, it wetted any further spray lodging on it will commence to run off. It has been shown experimentally that when free oil comes in contact with a wetted surface it does not necessarily run off but may build on the oil already deposited. Thus, when the spray lodges on the wetted leaf, if the emulsion breaks quickly some of the oil will remain to build up, and the run off will contain less oil than would be the case were the emulsion to break slowly. As the amount of oil deposited on the tree directly affects the scalicidal value, the quicker breaking the emulsion the greater the efficiency of the spray against the insect. It is, of course, possible to have a too quick breaking emulison, for the more oil there is left the more there will be absorbed into the tree. In practice, however, quick-breaking emulsions are necessary, and emulsifiers which satisfy in both particulars are generally used. The emulsifier also influences the spreading qualities of the spray, and in this again is an important component of any oil spray. For

reasons which are apparent from what has been stated above, the better the spreading quality the quicker breaking the emulsion required. It may be said then that, to a large extent, the lethal value of an oil spray increases as the margin of safety to the tree decreases, and as all oil sprays are chemically very similar the difference in brands is caused, to a very large extent, by the methods and substances used in effecting a compromise between the two. In so far as the brands of white oils marketed in Queensland are concerned it may be said that the safety of the tree has apparently been fully considered, and further that with those brands used at all extensively there has been little loss in insecticidal efficiency to bring about this result. In purchasing any of the brands of white oil at present sold extensively in the State, growers will obtain quite satisfactory spray material. Other brands, however, will no doubt appear, and growers should protect themselves by obtaining information on the essential properties as outlined above before purchasing.

The following are the data concerning two typical oil sprays of good quality:—

White Oil—

Unsulphonated Residue, 95 per cent.

Viscosity (Redwood) 1 at 100°F., 60-70 seconds.

Red Oil—

Unsulphonated Residue, 75 per cent. to 80 per cent.

Viscosity (Redwood) 1 at 100°F., 155 seconds.

It is essential that oil be applied to the trees well emulsified with water. Whilst growers almost always attend to the production of such an emulsion before the application commences, too often inefficient agitation is given whilst the spraying is in progress. The number of spraying outfits in the State which have either a very poor agitator or none at all in the vat is remarkably high. The ill effects of an oil spray are magnified by such a state of affairs, and the provision of good agitators must be treated as an urgent necessity.

Possible Ill Effects of Oil Sprays.

As has been stated above the white oils are very much less harmful to citrus trees than are the red. This, however, cannot be taken to mean that white oils are wholly beneficial to the trees. However, if used correctly these white oils are very useful sprays and can be recommended for the control of several species of scale insects. There is, however, much needless use of oil sprays in Queensland. Too often oil is used in the hope that it will control a pest. The attitude which should be taken is to use oils only when it is known that these will be successful. There is no doubt that a great many of the trees in Queensland which have never or rarely been sprayed with oil are superior in general condition to comparable trees which are regularly so treated. This refers to general effects, which may perhaps be termed cumulative.

Possible direct ill effects are varied. Generally, however, they are the result of failure to observe the conditions laid down with respect to oil spraying in general. Probably there is some little direct damage every time an oil is sprayed onto a citrus tree, but if precautions taken these ill effects can be reduced to insignificance. Almost any art of the tree may be adversely affected. Roots and the base of the

trunk are sometimes damaged by allowing an accumulation of oil to remain in contact with them after it has run down the trunk. The damage is most severe in the case of young trees, and with such it is wise to hill the soil up round the base of the trunk before application and to remove the mound shortly afterwards. Leaves, twigs, and fruit may be severely injured, and dropping of portion of the crop, particularly when the fruit is small, is possible. Partial or total defoliation of the tree may also be caused by the injudicious use of an oil, and in such cases a large proportion of the twigs may be killed back 6 inches or more. Less severely damaged leaves and fruit may remain on the tree, and these are usually spotted with brown markings or pitted, and the fruit thus rendered unsightly and depreciated in market value. Crop reduction may be caused in several ways, such as by the reduction of blossoming, or by the dropping of young fruit, and through the general health of the tree being impaired and the size and number of fruit being thus reduced. Retardation in colouring, both on the tree and in the colouring chamber, may also be caused by oil sprays. For this reason it is advisable to pick lemons immediately before spraying.

Trees in poor condition are much less able to withstand the ill effects of oil sprays than healthy ones, and allowance must always be made for that fact. A tree suffering from lack of water should never be sprayed with oil. As oils penetrate the plant it is obvious that the oil sprayed in the winter will affect the plant more than if applied during a period of free growth. Oils therefore should not be applied to citrus trees during a dormant period. Trees sprayed with oil during the winter have been kept under observation, and in some cases no great direct ill effect has been noted at the time. In every case, however, the oil has had some appreciable ill effect. Lighter blossoming, weakening of fruit-bearing wood, and premature heavy leaf fall are almost always to be noted. In other cases both direct and indirect effects have been observed. The maximum temperature at which a white oil should be used is about 100°F. At this temperature healthy trees not lacking water may be sprayed safely. However, it is recommended that oil spraying should be carried out in as cool weather as possible, taking into consideration the essential points concerning the pest being combated.

Growers should follow closely the directions given by the manufacturer of an oil. These include provision for maintaining an emulsion. Growers often complain that a certain brand of oil caused burning to their trees. No grower who has not an efficient agitator in his spray vat can possibly attribute injury to the spray oil as such. The oil and water should be measured. Haphazard guessing is the cause of much trouble. The procedure for mixing an oil spray is simple. The required amount of oil is measured into a tin and about twice that volume of water added. The emulsion is obtained either by pouring the mixture backwards and forwards several times from one container to another, or by forcing the mixture through a fine nozzle with a bucket pump. When the oil has thus been emulsified it is further diluted by being added to the bulk of the water in the vat.

Lime Sulphur.

Lime sulphur is a complex mixture of polysulphides of calcium together with small quantities of other compounds containing calcium, sulphur, and oxygen. It is a most useful spray material, and is probably

the one material which should be used on every citrus orchard in this State every year. Formerly lime sulphur was used extensively as a scalicide against a number of species, but for this purpose other substances, particularly oils, have displaced it to a very large extent. In Queensland at the present time lime sulphur is used for the control of one species only, namely white louse. At the same time it is effective to a certain extent against the crawlers of several other species of citrus scale insects, and in using lime sulphur against white louse a certain degree of control is exercised against these other species. Liquid lime sulphur is the form most commonly employed, and all recommendations for the use of this spray on citrus in Queensland refer to this form. In some parts of the world dry lime sulphurs are used to a certain extent, but the scalicidal value of these appears to be definitely lower than with the wet sprays.

For the most part, commercially made lime sulphur is employed, but the mixture can be prepared on the farm if so desired. Particulars of the preparation of home-made lime sulphur are to be found in "Pests and Diseases of Queensland Fruits and Vegetables," by Robert Veitch and J. H. Simmonds, a handbook published by the Department of Agriculture and Stock. Generally speaking, the home-made lime sulphurs are not altogether satisfactory. It is quite commonly found that the home-made operation may be successful several times and the next quite unsuccessful, though no known variation in the procedure has been adopted. A few citrus growers in the State do make their own lime sulphur and find it quite satisfactory, but it is considered that, on the whole, purchasing the manufactured concentrate is more satisfactory.

The strength of lime sulphur is indicated by the density, and to determine this a Baumé hydrometer is necessary. Concentrate prepared by the method given by Veitch and Simmonds will usually be found to be between 24° and 28° Baumé. It is the common experience in making home-made lime sulphur to find that the densities of successive lots vary considerably. Further, even commercial brands vary from one another, and even between different samples of the one brand. All recommendations for the use of lime sulphur at certain strengths are based on the assumption that the concentrate is about 32° or 33° Baumé, and it may therefore be necessary to make adjustments with different lots of concentrates. The following table, taken from "Pests and Diseases of Queensland Fruit and Vegetables," will enable the adjustments to be computed readily:—

TABLE I.

Density of Stock Solution in Degrees Baumé.	Dilution Required Based on a 33° Baumé Standard.				
	1 to 10.	1 to 15.	1 to 20.	1 to 30.	1 to 40.
25	7·6	11·4	15·2	22·7	30·3
26	7·9	11·8	15·8	23·6	31·5
27	8·2	12·3	16·4	24·5	32·7
28	8·5	12·7	17·0	25·5	33·9
29	8·8	13·2	17·6	26·4	35·2
30	9·1	13·6	18·2	27·3	36·4
31	9·4	14·1	18·8	28·2	37·6
32	9·7	14·5	19·4	29·1	38·8
33	10·0	15·0	20.0	30·0	40·0
34	10·3	15·4	20·6	30·9	41·2
35	10·6	15·9	21·2	31·8	42·4

It must be remembered, however, that of itself the density of lime sulphur gives little true idea of its insecticidal value, and because two such solutions are both 33° Baumé it does not follow that the insecticidal efficiencies are equal. The value of lime sulphur as an insecticide or fungicide has been shown to depend largely on the polysulphides present, and to gauge accurately the strength of the concentrate the percentage of polysulphides must be known. If, therefore, there is any doubt as to the composition, an analysis must be made if definite information is to be obtained.

Lime sulphur is used at strengths varying between one part of the concentrated stock solution to ten parts of water, and one part of the concentrated stock solution to thirty of water, or more according to the purpose for which it is required and the time of the year at which it is to be applied. The higher the prevailing atmospheric temperature the more dilute the lime sulphur must be. At strengths less than 1—15 lime sulphur has little value as a scalicide on citrus. It is the practice in some orchards to use this material regularly much stronger than 1—10, but such strengths are very rarely required for any purpose, and whilst little damage to the tree may result, lime sulphur is not a particularly cheap material and excessive strengths should therefore be avoided. With strengths such as 1 to 4 which are sometimes used in the winter little direct injury may be noted, but there is some reason for thinking that normal blossoming may be affected.

Correctly used lime sulphur is one of the most beneficial sprays known for citrus, at least in so far as Queensland is concerned. All the damage done by this spray is caused through using over-strengths. On the trunk and main limbs which are at all effectively protected from the sun, lime sulphur may be used at almost any strength at any time, but during the summer months foliage and tender twigs may be badly burned if the strength be greater than about 1—20, and in the hottest times of the year 1—30 or 1—35 is as strong as the material should be applied. Injured leaves are quickly shed, and fruit may also fall. More generally, however, burned fruit remains on the tree even if injured when quite small. If young fruit be injured the marking may grow in size with the fruit, and thus a very small amount of original injury may cause a considerable blemish to the rind of the mature fruit. As a scalicide lime sulphur is not used at less than about 1 to 12, and, therefore, its use for this purpose is confined to that period of the year when the only trees bearing fruit would be lemons and perhaps late valencias.

Washing Soda Wash.

A wash containing 1½ lb. washing soda to 4 gallons water formerly was used extensively for the control of wax scales, but it is now rarely used in Queensland, its place having been taken to a very large extent by the following mixture of soap and washing soda.

This spray has been displaced mainly on account of its rather drastic action on the trees. Under Queensland conditions the wash to be effective must be used in rather warm weather and severe injury to leaves and tender twigs frequently follows its use. The effect is particularly bad on weaker trees, and partial or even total defoliation may occur. In addition to this injury the washing soda spray has a definite tendency to harden the bark, and on healthy trees this is the greatest

objection to its use. The spray, however, cannot be considered a dangerous one to trees in good condition provided it is not used too regularly.

Soap and Washing Soda Mixture.

This mixture is made according to the following formula:—24 cakes Sunlight soap, 12-14 lb. washing soda, and 75 gallons water. To prepare the spray, dissolve the washing soda in as much water as can be boiled conveniently, and then add the soap. The soap will dissolve more readily if it be shredded. The mixture is then heated until all the soap has dissolved. Unless the quantity of water be very small it will probably not be necessary to actually boil the solution. The concentrate thus prepared is then diluted to 75 gallons in the spray vat. The mixture should be well agitated during the application. The spray is essentially a foliage one, and the application should be liberal.

Common soap may be substituted for Sunlight, but in no case have the results with other soaps equalled those obtained with the Sunlight. Clean fresh washing soda only should be used in making the mixture.

The addition of the soap is found to allow of considerable reduction of the washing soda without greatly impairing the scalicidal efficiency against the principal wax scale, that is, the pink wax, and at the same time the reduction in the amount of soda definitely reduces the harmful effects of the soda as described for the old washing soda wash. The soap tends to cause the spray to spread better, and assists in this regard also. The possible ill effects are similar to those given for the straight washing soda wash, but, as indicated, are felt to a considerably lessened degree.

Oil-Soap-Washing Soda Spray.

A combination of the soap and washing soda spray with oil is sometimes of value as a scalicide, especially when it is desired to combat mussel and pink wax concurrently. The mixture is also more effective against mussel scale than is straight oil. It is advisable to reduce the amount of soap and soda. In experimental work satisfactory results were obtained with the following proportions:—8 cakes Sunlight soap, 8 lb. washing soda, 1½ gallons oil, 75 gallons water. Oil and washing soda without soap is sometimes used. In hot weather, however, this spray is likely to cause severe burning to the leaves, and it is always advisable to include soap in the mixture. The soap spreads the spray well, and prevents its accumulation into drops which is generally responsible for the burning that results.

Any injurious effects following the use of this spray are mainly attributable to the oil it contains, and the damage is comparable to that done by oil alone. In some respects this spray is rather more drastic than straight oil, however, and its use should be confined to late summer and autumn months.

Resin-Soda-Fish Oil Spray.

This mixture gives a most efficient scalicide spray. Its greatest value is in the control of complexities of pests which include scale insects, but were it not that the preparation is rather cumbersome and requiring some little time, its use could be extended with considerable benefit. In those instances where it is recommended growers will find that they are fully compensated for the extra time and work involved

in its preparation. The formula of the spray is 10 lb. resin, 3 lb. caustic soda of good commercial quality, 1½ lb. fish oil, preferably herring oil, and 40 gallons water. The procedure for preparing the spray is as follows:—Firstly grind up the resin as finely as practicable, and then either mix the resin and the caustic soda while dry and add the mixture of these solids to 2 gallons water, or dissolve the caustic soda in the 2 gallons water and add the resin slowly while the solution boils gently. Generally the latter procedure is adopted. Whichever method be used the mixture must be boiled until a clear dark solution is obtained. The solution expands when hot, and if the volume of water be much in excess of half that of the container boiling over may occur. The fish oil is added to the clear dark solution when this is obtained, and the whole boiled for a few minutes to ensure that no free oil remains. The concentrate thus prepared is diluted for use with cold water. The agitator should be kept running while the application is in progress. If the concentrate is to be stored the fish oil should not be added before storage unless the mixture can be kept in perfectly airtight containers. When the concentrate cools a certain amount of solid is deposited, and thus when large lots are being prepared it is necessary to divide the stock solution while hot. This may be done by reheating stored lots or dividing up as soon as prepared. As most spray vats in use in Queensland have a capacity of either 40 or 75 gallons, the stock solution will be divided into lots of 2 or 3¾ gallons. The former method is preferable as it enables the addition of the fish oil at this stage to be made in such a way that thorough mixing is easy and assured.

In addition to its scalicidal value the spray has many beneficial effects on citrus trees, and if made correctly and applied at the right time it is an excellent general spray for these trees. It is, however, important to prepare the spray carefully, otherwise severe injury may follow its use. It is essential that the clear dark liquid described above be obtained, and all cases of injury to trees following the use of this spray in cool weather have been attributable to carelessness in preparation.

This spray must not be used in the very hot weather, and, in general, application should not be made when the temperatures exceed 90° F. Its general use, however, is restricted to periods when the temperature is about 10° lower than that maximum. If used in too hot weather severe burning followed by fall of both leaves and fruit may occur. Injured leaves and fruit are usually marked with a sticky deposit. This deposit may be present to a slight extent on uninjured parts, but does not persist on these, and the fruit may be covered with the material within a few days of being harvested.

COMBINATION SPRAYS.

It is possible under certain circumstances to mix a scalicide with a second spray to produce a combination which may be used with safety on the trees, and which at the same time retains the insecticidal or fungicidal properties of each of the constituent materials. Where this can be done it is very desirable for reasons both of economy and convenience. In mixing two spray materials in this way there are often precautions to be adopted, and because two such materials are stated to be compatible it does not necessarily follow that direct mixing can be done. Orchardists should therefore familiarise themselves with the

details of the preparation of such combinations. The following mixtures which include scalicides are of value to citrus growers in this State.

Lime Sulphur and Oil.

To a certain extent the mixture of oil with lime sulphur comes under the heading of both combination and simple spray. Whilst the properties of the lime sulphur for purposes other than the control of scale insects are preserved, the mixture also forms a spray which, under certain circumstances, is a better scalicide than the straight oil. Most miscible oils do not form stable emulsions in the presence of lime sulphur unless a special emulsifier be added. The emulsifier or stabiliser for the purpose is casein. The casein is dissolved in the water and the previously emulsified oil is then added. This mixture is agitated well and the lime sulphur then added. The amount of casein required varies with different oils and different lime sulphurs, but generally 1 lb. of casein to each 100 gallons of spray suffices. There are a number of white oils on the market which can be mixed directly with lime sulphur, and when the combination is desired they are usually preferable. Such oils are usually specially marked as directly miscible with lime sulphur.

Oil, lime sulphur combinations are very useful, but should be used with great care, as severe burning of fruit and foliage may result if the mixture be applied in very hot weather. The maximum safe temperature can be set down as about 90°F. It is, however, unwise to use the combination at the maximum temperature unless the trees be in good condition. In this State the use of the combination spray is therefore restricted to early summer and late summer or autumn months. The spray is particularly severe on young growth, and its use at times when there is much new growth cannot be recommended. It should not, of course, be used on dormant citrus trees.

Bordeaux Mixture and Oil.

Oil may be added to Bordeaux mixture to form a safe combination spray provided the oil be well emulsified before it be mixed into the other material. The procedure recommended is to use a good brand of oil, thoroughly emulsifying it with about double its own volume of water. When a good emulsion is obtained stir it well into the prepared Bordeaux mixture. The amount of oil to be used is generally mentioned as 1 per cent., but this amount can be exceeded by ½ per cent. without injury to the trees. The essential point to be observed is that there must be no free oil present at any time during the application. Whilst the 1 per cent. combination has some scalicidal value it cannot be recommended as likely to be of much value against heavy infestations of most scale insects. It is, however, of use on lightly-infested trees. The greatest point in favour of the mixture is the improved spreading quality of the Bordeaux.

Oil and Nicotine Sulphate.

Oil and nicotine sulphate may be safely mixed. A spreader is sometimes added to ensure greater safety, but this is not essential. Nicotine sulphate is, however, very seldom required on citrus in this State, being used on citrus only for the control of aphis. This insect rarely needs to be artificially controlled, and when this is necessary it is usually at a

time when the trees are very susceptible to injury from oil sprays. The combination is therefore of little value as a citrus spray in Queensland.

Lime Sulphur and Arsenate of Lead.

Lime sulphur may be mixed with acid arsenate of lead to form a very useful and safe spray combination. However, when used in this way lime sulphur is not being employed as a scalicide as a general rule, but for the control of Maori mite or red spider. On occasions, however, the combination may be used in connection with the control of scale pests. In mixing the two materials the lime sulphur is added to the water in the first place, the arsenate of lead being mixed separately into a paste in the same way as when the poison is being used alone. A little more water is then added to the arsenate of lead paste and the whole mixed into the lime sulphur solution.

Soap and Washing Soda and Burgundy.

Burgundy mixture may be combined with soap and washing soda mixture to form a combined spray for use against wax scales and fungi. The mixture is at times very useful. The two sprays should be prepared separately and mixed later. In experimental work a little burning was caused at times when full strengths of both constituents were used, and though this was never serious and not invariable, it is perhaps advisable to reduce the soap and washing soda in the scalicidal portion of the spray. It was found that the soap may be reduced to fifteen cakes and the soda proportionally without undue loss of scalicidal efficiency.

Soap and Washing Soda, and Nicotine Sulphate.

Soap and washing soda, as described in an earlier paragraph, and nicotine sulphate may be mixed together to form a useful combination spray. It sometimes happens that towards the end of summer, particularly in years when the rains have been falling over a protracted period, the late growth may not harden for a considerable time and the aphis then becomes somewhat of a menace and may need attention. In such years pink wax control may be required at a time at which the aphis can be conveniently combated. Under these circumstances the combination of soap and soda with nicotine sulphate may be of value. The nicotine sulphate is added to the soap and washing soda in the usual proportions, that is, ½ pint to 50 gallons.

Soap and Washing Soda, and Lime Sulphur.

This combination has a very limited use. It is only of value when a protracted hatch of pink wax has occurred, and it becomes necessary to combat pink wax and Maori at the same time. The spray must be used with great care, as severe burning often results. On no account must the amount of soap be reduced. The combination is too drastic to permit of its being generally recommended, but at times it may be of use.

COMPATABILITY OF FOLLOWING TREATMENTS.

There is no problem which citrus growers of this State have to face which gives more concern than the question of what sprays may be safely used in succession to one another. The trouble is due to a large extent to the use of fungicides containing copper compounds as the

principal ingredient. Once such a spray has been used many of the most useful scalicide materials cannot be employed for a considerable time. The search for substitutes for these copper containing sprays has so far met with little success. Attention has recently been directed to the use of zinc sulphate and lime as an alternative to copper sprays for certain diseases. This spray has so far not been proved to be of any value against the major fungous troubles of citrus in the State, and there does not appear to be much likelihood that this substance will be recommended as a substitute for Bordeaux or Burgundy mixtures for general use on citrus.

The question of compatability is, of course, not confined to the class of sprays just mentioned, but must be considered with other sprays also. It is advisable, therefore, in drawing up a programme of pest and disease control, to give full consideration to the compatability of all the sprays which may need to be used for the following twelve months. The more important following treatments are discussed below.

Bordeaux Mixture and Oil.

Although Bordeaux mixture and oil may be used as a combination spray care must be exercised in applying the two as separate sprays to the one tree. In general at least two months should elapse after an application of Bordeaux before oil is applied, and unless the removal of residual Bordeaux has been assisted by good rain it may be advisable to wait still longer. In practice, however, two months usually suffice, for unless an appreciable amount of rain has fallen in that interval the trees will not be in a fit condition to spray with oil. That Bordeaux may follow oil within a shorter period is of little value, for in the control of most of the major diseases of citrus in this State the initial fungicide application must be made early in the spring and the treatment repeated at least once before mid-summer. Thus the use of oils before Bordeaux cannot be recommended for reasons arising out of the use of oil alone. The only occasion on which the procedure may be required is when rots of the fruit such as are caused by *Phytophthora citropthora* Sm. et Sm. occur. This type of rot is uncommon and is only in evidence in wetter times. In such cases Bordeaux may be applied to trees previously sprayed with oil when desired, for the latter material will always have been used in the late summer or early autumn and the rots are never much in evidence until well into the winter.

Fumigation and Bordeaux Mixture.

The effect of fumigating a tree which carries a residue of Bordeaux is disastrous, and at least six months should be allowed to elapse after applying the spray before fumigation is carried out. Even in that length of time the procedure cannot be said to be entirely without risk. To definitely eliminate all possibility of damage the period would have to be almost twelve months. In experimental work a number of trees were fumigated less than three months after having been sprayed with Bordeaux and no injury resulted. This was done in a very dry period following one of heavy rain, and it would appear that under such circumstances the intervening period may be considerably reduced. However, if less than six months be allowed to elapse great care must be exercised, and orchardists should proceed slowly. As the damage to the trees is so great no chances should be taken, and in general it cannot be recommended that fumigation should follow Bordeaux spraying

Bordeaux mixture may, however, be applied quickly after fumigation. Although in theory the spray may be applied immediately after the fumigant has left the tree, in practice it has been found advisable to wait at least ten days.

Lime Sulphur and Bordeaux Mixture.

The use of lime sulphur against white louse in the late winter may need consideration in cases where Bordeaux is to be applied early in the spring. When these two materials are mixed a heavy black or dark-brown deposit, probably a copper sulphide, is formed. This precipitate is very insoluble, and apart from covering the trees does no damage. The reaction which brings about its formation, however, leads to a reduction in the efficacy of both spray materials, and the close following of one spray by the other in either order is therefore to be avoided as far as possible. In general the order in which the material will be applied in so far as scale insects enter into the question is lime sulphur first and then Bordeaux. The reverse order may be required when Maori mite or red spider control has to be undertaken. The question of spraying programme in these cases will be dealt with in connection with the control of such complexities in the discussion of the control of scales in various districts.

Bordeaux Mixture and Resin-Soda-Fish Oil.

These sprays may be applied within about a month of one another in either order without injury to the tree. In practice, however, there are few, if any, occasions on which Bordeaux will be required to follow the resin spray in so short a time. The reverse procedure is much more commonly called for, and as the sprays may be used in quick succession the resin-soda-fish oil mixture becomes a most valuable scalicide.

Oil and Resin-Soda-Fish Oil.

The resin-soda-fish oil spray should not be applied within less than at least three months of an oil. If the sprays be applied in that order in too short a time, heavy fall of leaf is probable and small twigs may be killed. In the experimental trees the injury to well-grown fruit was, however, slight. The reverse order of application is not likely to be considered and has not been tested.

Lime Sulphur and Oil, or Sulphur and Oil.

The problem of following lime sulphur or sulphur with oil can be overcome largely by the use of a combined spray of oil and lime sulphur. Where it is known that both materials will need to be used at about the same time the combination should always be used if conditions permit. In no case should oils be used immediately following sulphur dust or lime sulphur. In the case of lime sulphur the period between the two applications should be at least one month, but preferably longer. If the combination spray cannot be used owing to weather or other such circumstances, it is preferable to use sulphur dust rather than the lime sulphur for the control of mites.

Fumigation and Oil.

Fumigation may be followed by oil spraying, or oil spraying by fumigation within a few days without injury to the trees. Unless it be

unavoidable, however, it is wise to allow at least a fortnight to elapse between the treatments. There should never be any occasion in Queensland for requiring the two treatments within such a short period of one another. If it be known in advance that both these treatments will need to be given, it is recommended for preference that the fumigation be carried out first.

FUMIGATION.

Whatever method of generating the gas be used the procedure in fumigating a citrus orchard is essentially the same. The tree to be treated is first covered with a tent. These tents, or sheets as they are usually styled, may be of any material which fulfils the following conditions:—It must be of close enough weave to ensure that the gas will escape only very slowly, strong enough to stand the wear to which it will be subjected by being dragged around the orchard and over the trees, and not so heavy that it will be difficult to handle in this work. Most fumigation sheets in use are made of duck or drill. Drill is inferior to duck, and the most satisfactory material employed is special 8—10 oz. army duck. A medium weight calico of close weave gives perfectly satisfactory results in so far as the kill of insects is concerned. This material has the advantage that it is cheaper to purchase than the duck, but the life of a calico sheet is, of course, less than the stronger duck. Calico would perhaps appeal most to orchardists starting with an orchard which has not yet commenced to pay its way, and in this and other cases may be of considerable value. In the experimental work a medium weight close woven English calico, costing 1s. 6d. per yard (72 inches wide), was used. The results obtained with this were equal to those obtained with 10 oz. duck costing approximately 2s. 6d. per yard. Thus from about £25 to £30 will be saved by using the calico for an equipment of twelve sheets.

The sheets are usually eight-sided and are of various diameters. The number of sheets will depend on the size of the orchard and the means of the grower, but where possible an outfit should include at least twelve sheets, and twenty can be easily handled by a gang of four men who know anything about fumigation. The diameters will depend on the size of the trees, and in purchasing sheets due allowance must be made for the growth of the trees during the following five or six years. If given careful treatment a sheet should last at least that length of time, and it is unwise to acquire tents which will be of no use long before they are worn out. Sheets may be enlarged by adding an extra width of material to the edges, but it is much better to obtain whole sheets in the first instance. The smallest size sheet which should be purchased should be about 30 feet in diameter. If a sheet is to be enlarged drill may be used, as it is quite satisfactory to form the flaps towards the bottoms.

The size of the sheet required to cover a tree varies with the habit of growth of the tree, and it is difficult to give an accurate idea on this point. An Emperor of Canton mandarin 10 feet high, for example, will usually be covered by a much smaller sheet than a Scarlet of the same height. The sheet should reach well to the ground, and allowance must be made for that fact. Roughly it may be said that a well-shaped tree 10 to 12 feet in height will require at least a 33-foot tent; and more probably a 36-foot one will be needed. The largest sheets commonly used are 55 to 60 feet in diameter, though on some Queensland orchards 80-foot sheets are in use.

In order to protect the sheets from attack by mildew these are sometimes given a treatment with tannin. This treatment tends to lengthen the life of the tent, but there is no evidence that it increases its gas-holding capacity. The tents are treated by being dipped in a vat of hot tannin solution. They are immersed for about half an hour and then spread out on the ground to dry. The strength generally recommended is 40 lb. of bark to about 100 gallons of water, but as the tannin content varies a definite amount of water cannot be given.

In fumigating an orchard a tent is placed on the end tree of each row for as many rows as there are tents. The tent is hauled over the tree with the aid of one or two poles according to the size of the tent and tree. These poles should be light and at least 18 feet long for use in most orchards, particularly where lemons are grown. The essential point about the poles is that they must be sufficiently long to allow of the tent being raised in such a way that branches towards the top of the tree will not be caught under the sheet when it is being pulled up. With short poles limbs are frequently broken by being so caught, and the risk of the sheet being torn is greatly increased. From the first tree in each row the sheet is transferred directly to the next. That is, after the first tree each day the sheets are not again brought to the ground except at the conclusion of operations.

The dosage is calculated on the amount of space beneath the sheet. This depends on the dimensions of the sheet when in position. There are two systems in use—the distances over and around, and height and diameter. The former gives a rather more accurate result, but in Queensland the height and the diameter are the measurements almost always taken. These give sufficiently accurate data. The distance over the tree may be found most easily by marking the sheets, so that when in position the measurement is automatically registered, and in this case the distance around is obtained by running a tape around the outside of the sheet. The height may also be found by a marked sheet, but generally a light pole plainly marked in feet is used, and this pole is also used for determining the diameter. The markings must be plain enough to be readable when the pole is in the vertical position against the high trees. The dosage is determined by reference to tables specially prepared for the purpose (see Tables II., III., and IV., pages 22, 23, and 24).

If the "pot" method be used the only other equipment necessary is the earthenware pots and the various measuring vessels and supply vats. With any other method a machine is either necessary or desirable as described in connection with each in earlier paragraphs. If Cyanogas is being employed it is desirable to obtain a supply of specially-graduated spoons. These spoons hold exact known quantities of the dust and thus save any weighing and allow quick and accurate working.

Conditions and Precautions.

In almost every fumigation season numbers of trees are injured or poor results obtained against scale insects through neglect by fumigators to observe conditions which, for the most part, are quite well known. Fumigation is no work for a careless man, and, if the safety of trees and operators combined with good results against the pest are to be

TABLE II.

POTASSIUM CYANIDE.

45 MINUTES EXPOSURE.

Diameter of Tree (feet).

Height of Tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1	1																
5	1	1	1	1½	2															5
6		1½	1½	2	2	2½	3	4	4											6
7		1½	1½	2	2½	3	4	4	4	5										7
8				2½	3	3	4	4	5	6	6	6	7							8
9				2½	3	3	4	4	5	5	6	6	7	7						9
10				3	3	4	4	4	5	5	6	6	7	8	9					10
11					4	5	5	5	6	6	7	7	8	9	10					11
12						5	5	6	6	6	7	8	8	10	11	12	13	15	17	12
13						6	6	7	7	7	8	9	9	12	13	14	15	16	18	13
14							6	7	7	8	9	10	11	13	14	15	17	18	18	14
15								7	8	8	10	11	12	14	14	16	18	20	20	15
16									9	10	12	12	13	14	15	17	18	20	21	16
17										12	13	13	14	15	16	18	20	22	22	17
18											13	13	15	16	18	20	22	23	24	18
19												15	16	18	19	21	23	25	25	19
20													17	19	21	23	24	25	26	20
21													19	19	21	23	25	26	27	21
22														21	22	24	25	26	27	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Doses in Ounces.

Proportion: Cyanide, 1; Sulphuric Acid, 1; Water, 3.

TABLE III.

CYANOGAS DUST.

45 MINUTES EXPOSURE.

Diameter of Tree (feet).

Height of Tree (feet).

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1	1½																4
5	1	1	1½	1½																5
6	1	1½	1½	1½	2	2½	3	4	4											6
7	1	1½	1½	2	2½	2½	3½	4	5	5½										7
8		1½	1½	2	2½	3	4	4½	5½	6½	7½	8½	10							8
9			2	2½	2½	4	4½	5	6	7	8½	9½	11	12½						9
10				2½	3	4	4½	6	7	8	9½	10½	12	14	15½					10
11					3½	4½	5	6½	7½	9	10	12	13½	15	17	19				11
12					3½	4½	6	7	8	10	11	13	14½	16½	18½	20½	23	25	27½	12
13							6	7½	9	10½	12	14	16	18	20	22	24½	27	30	13
14							7	8	9½	11	13	15	17	19	21½	24	26½	29	32	14
15								8½	10	12	14	16	18	20½	23	25½	28½	31	34	15
16								9	11	13	15	17	19½	22	24½	27½	30½	33½	36½	16
17									11½	13½	16	18	20½	23	26	29	32	35½	39	17
18									12½	14½	17	19	22	24½	27½	31	34	37½	41	18
19									13	15½	18	20½	23	25	29	32½	36	39½	43½	19
20									13½	16	18½	21½	24½	27½	30½	34	38	42	46	20
21												22½	25½	29	32½	36	39½	44	48	21
22												23½	26½	30	34	37½	41½	46	50½	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Doses in ounces.

Table recommended by manufacturer and used in experimental work.

TABLE IV.

CALCID BRIQUETTES.

40 MINUTES EXPOSURE.

Diameter of Tree (feet).

Height of Tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1½	1½																4
5	1	1	1½	2																5
6	1	1½	1½	2	2½	2½	3	3½	4											6
7	1	1½	2	2	2½	3	3½	4	4½	5										7
8		1½	2	2½	2½	3	3½	4½	5	5½	5½	6	7							8
9			2	2½	3	3½	4	5	5½	5½	6	7	8	9						9
10				2½	3	3½	4½	5	5	6	7	8	9	10	11					10
11					3½	4	4½	5	6	7	8	9	10	11	12	13				11
12					3½	4	5	5	6	7	8	10	11	12	13	14	16	17	19	12
13							6	6	6	7	9	10	11	13	14	16	18	20	22	13
14							6	6	7	8	9	11	12	14	16	17	19	21	23	14
15								6	7	8	10	11	13	15	17	19	21	23	25	15
16								7	8	9	11	12	14	16	18	20	22	24	27	16
17									8	10	11	13	15	17	19	21	24	26	29	17
18									9	10	12	14	16	18	20	22	25	28	30	18
19									10	11	13	15	17	19	21	24	26	29	32	19
20									10	11	13	15	18	20	22	25	28	31	34	20
21												16	19	21	24	26	29	32	35	21
22												17	19	22	25	28	31	34	37	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Doses in Number of Briquettes.

Table recommended by manufacturer and used in experimental work.

ensured, attention must be paid to detail. The most important conditions which are to be observed may be briefly stated as follows:—

If the pot system is being used the work must be done in the absence of sunlight, for if this method be used during the day serious injury to the trees may result. Calcium cyanide, however, may be safely used in the day time, even on the brightest days.

It is essential that the dimensions of each tree be determined accurately. Guessing the dosage is very inadvisable.

The humidity of the atmosphere must be considered. Wet trees must never be fumigated, and generally it is wise to cease operations when there is any damp feeling in the air. With calcium cyanide humidity is usually of minor consideration, but when night work is being done dew often necessitates discontinuance. Very often work is commenced in the morning with sheets which are far from dry, and this leads to much trouble. When there is any chance of the sheets becoming wetted overnight, they should be placed under shelter. Even if they be but placed in a group and covered by one other sheet a good deal of time and trouble can be avoided. Wet sheets pick up much dirt and grit, and scratching of the fruit results from friction when the sheets are being pulled over the trees. Scratched fruits, besides being blemished, are more susceptible to cyanide injury than sound ones, and the sheets should therefore be kept as clean as practicable.

Temperature is of greater consideration than humidity as a rule. When the pot method is being employed fumigation should cease when the temperature is greater than about 75°F. in coastal parts and 80°F. in interior districts. When calcium cyanide is being used, however, the upper limit is much higher, and under most conditions healthy trees remain uninjured at temperatures 10° to 15° F. higher in both cases. In many cases trees have been fumigated with calcium cyanide in interior districts at 100°F. or even a little higher with very little or no ill effects. Care, however, must be exercised when working at these very high temperatures, and a close inspection made so that if any damage is being done it will not go too far. As a general rule on typical hot summer days in Queensland it is advisable to discontinue fumigation between about 12.30 p.m. and 3 p.m.

The tree should be covered for about forty-five minutes. Under good fumigating conditions, particularly if the humidity be fair to good, the interval may be reduced to forty minutes, but under no circumstances should the time be extended to more than about fifty minutes. There is nothing to be gained by increasing the time to an hour as is sometimes done, and there is distinct risk of injury. Further, it is not advisable to have the trees covered for any great length of time before the charge is applied.

The soil of the orchard should be sufficiently well cultivated to permit of the sheets making good contact, and often it is desirable to throw a little soil on the bottoms of the sheets so that they make close contact with the ground. The soil should not be so wet that the humidity of the amosphere enclosed by the tent will quickly be altered appreciably, and for this reason irrigation should not immediately precede fumigation. At the same time trees which are suffering from lack of water are definitely less resistant to the gas than others, and in general the healthy trees suffer less than those in poor condition.

Different varieties of trees show different tolerance to the gas. With the pot method lemons usually are found to be more resistant than oranges, and oranges more so than mandarins. With calcium cyanide, however, the order is different. Oranges are the most tolerant when this form is used, and lemons markedly the least. Under Queensland conditions, however, the order of tolerance is rarely of moment. Young growth in all cases is more susceptible to injury than is hardened growth, and when there is much new growth on the trees fumigation should be postponed as long as possible. In no case with trees other than lemons, where it cannot be avoided, should trees carrying fruit less than about three-quarters of an inch in diameter be fumigated. In ideal circumstances fruit which is well set is not usually affected to any appreciable extent, but fumigation is not to be recommended at so early a stage in the development of the fruit.

Care must be taken to see that the sheets are as gas-tight as possible. They must be touching the ground firmly all round, and all folds must be arranged so that they do not enclose any great air space. Careful inspection should be made at short intervals for tears, and these should at once be mended. Many tents become badly torn because small holes are not attended to early. Apart from the efficiency of the fumigation being lowered in the meantime, sheets are too expensive to treat in this way.

Fumigation is seldom effective if carried out in windy weather. The wind tends to increase the leakage, and fumigation under badly-flapping tents is useless. Furthermore, it has sometimes been observed that the kill is less on trees close to ones fumigated in windy weather than would normally be expected. It would appear possible that in such cases the insects on the former trees may receive sub-lethal doses carried to them by the wind and thus develop a tolerance to the gas. The resistance is small and does not apparently persist, but it is advisable for this reason, as well as others connected with the insects themselves, to work towards the wind and refrain from fumigating in very windy weather.

SPRAYING.

It is obvious that no matter how high the insecticidal efficiency of a material may be the insect must receive a certain amount before any result can be expected. In the case of contact insecticides in use against scale insects this means that the pest must be adequately covered by the spray. It is therefore necessary to know just how the material was applied before any assessment of its worth can be made. Bad spraying is much more common than bad sprays, and every year quite good spraying materials are condemned by growers who do not take into consideration the manner of application. It is by no means an easy task to spray a well-grown citrus tree thoroughly, and if satisfactory results are to be obtained against scale insects by the use of sprays, attention must be paid to details.

In spraying there are two important units—the man and the machine. For efficiency an active man is necessary, otherwise both time and material will be wasted. No man can effectively spray unless he gives the whole of his attention to the work. For this reason also a good horse is an asset, for if a man has to be continually speaking to and looking at the horse he cannot possibly give adequate attention to the work on hand.

It is advisable to work always to a system. Any system which ensures that the whole of the tree will have the maximum chance of being covered must include the following points:—The inside of the tree will be done first, and each branch will be traced out to its end. Special attention must be given to topmost parts. In spraying the outside it is necessary in the first place to make sure that the hose will reach to every part of the tree, and this can only be done by walking to the full length of the hose before commencing at each tree and then working back towards the machine. If this is not done it may be found on walking round the tree that the hose is too short to reach the point where the spraying began. If the unsprayed section be large it will be noticed, but in other cases it may be left unsprayed. In either case there will be loss of time or efficiency. If two men be spraying together they should work at an even pace, otherwise one man will be wasting time and material or the other will skimp the last part of many trees.

The spraying outfit of many Queensland growers at the present time is hopelessly inadequate, and if scale control is to be improved much of the present equipment will have to be discarded. There are a number of very satisfactory machines on the market for reasonable prices, and it must be remembered that efficient spraying is a very profitable undertaking.

It is impossible to spray a citrus tree effectively with a pressure of less than 175 lb., and for really good work at least 300 lb. is necessary. Of almost equal importance to high pressure is constant pressure. It is not possible to do efficient spraying when the pressure is fluctuating over a range of about 75 or 100 lb. as is often found to be the case. The vat should be fitted with a good strainer, and above all an efficient agitator. Too much emphasis cannot be placed on the necessity for good agitation in the vat. Many spray materials are harmful to both the pump and the hoses, and residual spray material should be cleaned out immediately after an application is completed. Apart from this, cleaning eliminates accidents arising at the following spraying through the unintentional mixing of two incompatible materials or the application of the first material at the wrong time. The frequency with which growers neglect to repair small defects in the spraying outfit until these are actually required for use is rather remarkable. The result is often much inconvenience and loss of valuable time.

The hose should be about 30 feet long and of good quality. The junctions of hose to the pump and the rod should be kept tight. Nothing wears a hose out more quickly than kinking when the pressure is on, and kinks can be avoided to a large extent if the operator make two half turns instead of one complete turn. The rod should be long enough to ensure that the tops of the trees can be well sprayed. Six feet rods are the minimum length of much value, and generally 8-foot lengths are required. Light bamboo rods have the advantage that they are thick enough to hold with comfort and they do not become greasy with spray as do the metal ones. One nozzle to each rod gives fairly satisfactory results, but two set on a Y-piece, so that the cones of spray intersect about 9 inches from the opening, give by far the best results. The orifice in the nozzle should be as fine as the spray material being used will permit, and it must be remembered that the holes are enlarged quickly by certain materials. Lime sulphur is the only scalicide requiring a nozzle which is at all coarse. Drench spraying uses more

material and does not give as good a cover on citrus as the mist. The spray rod should always be held at an angle so that the leaves are twisted and not merely pushed out of the way, as happens when the spray is directed flat on to the surface.

Spraying should not be commenced whilst the trees are wet, and should be discontinued at least half an hour before rain. Most sprays will require at least that length of time to dry, and this must be given consideration. Effective spraying is not possible in very windy weather. These points are very obvious, but the frequency with which they are ignored is remarkable.

Spot spraying could be practised to a much larger extent than is the case, but it is bad practice to neglect to treat a particular tree merely because it is unproductive. If a tree is not worth spraying it should be destroyed and certainly not left as a breeding ground for pests and diseases.

Any citrus tree with the normal amount of foliage is difficult to cover with spray, but those which are correctly pruned are certainly more easily so treated than others. As a preliminary to any spraying it is necessary to prune the tree, and, in general, trees should be kept as open as possible, having due regard, of course, for the other effects of this on the tree.

In mixing sprays it is essential that the ingredients be measured, and a good deal of the trouble which occurs would be avoided if this point were borne in mind. Fresh materials should be used, and if it be necessary to keep materials for any length of time they should be stored in airtight containers preferably in a cool place. Water is an important component of every spray. Generally rain water is available for this purpose, but if well or other water must be used it is necessary to have a test made to discover its suitability. A water is not necessarily fit for spraying because it is declared suitable for certain domestic purposes.

Lime sulphur is the only scalicide used to any extent on citrus in this State with which a spreader is advisable, and for this casein may be used. Some of the miscible oils do not spread very well, and with these a small quantity of soap improves the spreading qualities.

COMPARISON OF FUMIGATION AND SPRAYING.

Judged purely from the standpoint of efficacy against every species of scale insect on citrus, where it can be correctly carried out fumigation is preferable to spraying. Unfortunately, however, fumigation cannot be recommended for use in several of the largest centres of production. On the Blackall Range and in similar localities climatic conditions prohibit the use of the fumigant for the greater part of the year. Here winds are practically constant and wet days numerous throughout the period in which the work would have to be done, and the continuity of operations would almost always be badly broken. In these districts spraying must therefore be used for the most part.

In all districts the numerous small growers find the cost of equipment too great, for not only is the initial outlay high but depreciation has to be considered. Again, in many parts fumigation does not eliminate the necessity for a spray plant. Even though fumigation is effective against a large number of pests there are others—for example, the bronze bug—which must be considered, and diseases such as melanose

(*Phomopsis citri*) and black spot (*Phoma citricarpa*) must be combated with wet sprays. Further, whilst fumigation is undoubtedly superior against scale and many other pests, other satisfactory methods are known, and therefore where outlay of money must be considered primarily growers generally do not use fumigation.

TABLE V.

TESTS OF SCALICIDES.

PERCENTAGE KILLS OBTAINED IN EXPERIMENTAL WORK. POOREST AND BEST RESULTS GIVEN: KILLS CALCULATED ACCORDING TO METHOD DETAILED IN TEXT.

——	Red Scale.	Circular Black Scale.	Mussel Scale.	White Louse.	Pulvinaria.	Pink Wax.	White Wax.
Fumigation—Pot method	95–98	96–99	97–99	98–99	*a*	92–97	*a*
Fumigation—Cyanogas	97–98	98–99	98–99	98–99	*a*	89–92	*a*
Fumigation—Calcid	98–99	98–99	*a*	98–99	*a*	93	*a*
Resin-Soda-Fish Oil	97–99	98–99 leaves 90–94 fruit	98–99	95–97	98–99	96–98	94–98
White Oil ..	94–97	97–98 leaves 85–92 fruit	87–93	89	94–95	*b*	*b*
Red Oil	94–97	97–99 leaves 87–92 fruit	89–93	89	94–95	*b*	*b*
Soap-Soda ..	*b*	*b*	*b*	*b*	*b*	94–96	88–91
Washing Soda ..	*b*	*b*	*b*	*b*	*b*	95–96	93–96
Oil-Soap-Soda ..	93–96	*a*	92–96	*a*	*a*	92–96	*a*
Lime Sulphur ..	*b*	*b*	*b*	94–97	*b*	*b*	*b*
Oil, Lime Sulphur	91–95	97–98 leaves 79–83 fruit	*a*	96	*a*	*b*	*b*

a No data.
b Scalicide of little or no value against particular pest.

At the same time fumigation is superior, not only in the action on scale pests but also because it is so much more thorough than the best spraying. For this reason, and because fumigation is effective against so many pests concurrently, it is almost invariably the most economical scalicide that can be employed in suitable districts. Where the outlay for equipment is not of paramount importance fumigation is to be recommended in preference to spraying. A good deal can be done by co-operative effort. A scheme whereby a group of orchardists purchases an outfit which is available to each member at all reasonable times for but a very little outlay has been shown to be practicable by the growers in the Gayndah district.

THE INFLUENCE OF BORDEAUX MIXTURE ON SCALE INSECTS.

The continued use of Bordeaux mixture on a citrus tree may profoundly influence the scale insect position, not only with respect to degree of infestation but also with respect to the species of scale insects present. It appears that the effects are produced principally in three ways—namely, by rendering the use of several important scalicides impossible without great risk of injuring the tree, by the destruction of entomogenous fungi, and by the effect of Bordeaux on the plant itself.

The first of these is at times the most important, but there is now some method by which the trouble can be overcome. In certain cases, however, even if the difficulty be surmounted by the use of an alternative scalicide there may be loss in efficiency resulting in increase in population.

The destruction of entomogenous fungi was at one time thought to be the outstanding, if not actually the sole, reason for the increase in scale infestation following the use of Bordeaux. This, however, does not appear to be the case, for the evidence collected during the course of this work indicates that it is only on very rare occasions that these fungi exercise any appreciable degree of control. Though the commonest fungi are found in every major citrus-producing district, in certain parts they are found only very rarely, and then but a few insects are affected as a general rule. However, it is almost invariably found that scale insect infestation increases whenever and wherever Bordeaux is used at all extensively.

It is considered that by far the most important factor in most cases is the effect of the spray on the tree itself. The effect is, of course, the more pronounced the more Bordeaux is used. For the control of most of the major fungous diseases of citrus in the State several applications of Bordeaux are necessary in fairly quick succession. Thus cumulative effects are the rule. It is known that the copper from the fungicide may be absorbed into the plant, and copper so absorbed may be incorporated into the chlorophyl, resulting in the destruction of that substance for the purposes of photosynthesis. It is possible that it is through the chlorophyl that the effect of the spray is felt, but whatever the actual process, it is certain that citrus trees repeatedly sprayed with Bordeaux lose vigour. Where very heavy applications are made the loss becomes visibly manifested in heavy premature leaf fall, reduction in crop, and production of much weak growth. It will be readily understood that scale insects are very sensitive to the condition of the tree, and loss of vigour is quickly indicated by these pests. It will be seen by reference to the habits of red and mussel scales that these species are quick to take advantage of weakened condition of trees. It is true also that it is these species which increase to the greatest extent following the use of Bordeaux. Were the position affected only by the destruction of the entomogenous fungi it would be expected that the species of scale originally or habitually present would show the greatest increase. This, however, is not the case. Thus in recently-conducted experiments Emperor of Canton mandarin trees which usually were found to carry an appreciable infestation of pink wax only were repeatedly sprayed with Bordeaux. On these trees pink wax soon became a very minor pest, and in fact on several trees was represented by but a very few individuals. At the same time both red and mussel scale, particularly the latter, increased to such an extent that at one stage it appeared likely that the trees would be killed, or at least very badly injured. These trees

were oversprayed for experimental reasons, but similar effects have been noted in many other cases. As all the species of scale mentioned are hosts of the commonest entomogenous fungus the decrease in pink wax can scarcely be accounted for in that direction. It is therefore considered that the increase in scale insect population following the use of Bordeaux in most cases cannot be attributed to the fungicidal action of that spray but to its adverse effects on the tree. Bordeaux mixture is a most valuable fungicide and must be used if certain of the more important citrus diseases are to be controlled. It is apparent, however, that when this material is to be used growers must take what action they can to ensure as good growing conditions as possible for the treated trees, and a scalicide must be included in the spraying programme for the year.

IMPORTANCE OF TIME OF APPLICATION OF SCALICIDES.

It is very commonly assumed that because a certain percentage of the scales on a tree have been killed that an equally good degree of control has been established. It is the common practice also for growers to submit specimens from sprayed trees asking for information as to the kill obtained. That the first assumption is unwarranted and how misleading the figures obtained in the second event may be is shown by the analysis of the results of the following experiments carried out during the course of this investigation.

In the first experiment trees heavily infested with red scale were sprayed during the early part of January. Counts made fourteen days after the application showed that approximately 98 per cent. of the red scales were dead. Six weeks later a further series of counts was made and the figures then available were:—

Average number of living scales per fruit before application—

Sprayed trees	31·2
Unsprayed trees	28·45

Average number of living scales per fruit at time of third count—

Sprayed trees	16·5
Unsprayed trees	401·6

Assuming the rate of reproduction on all trees to be the same, it will be seen that an apparent kill of 96·25 per cent. had been obtained. Allowing for errors due to inability to handle sufficiently large numbers of individuals, the kills computed fourteen days and two months after application agree fairly well. Taking the figures for the sprayed trees, it will be seen that although a kill of at least 96·25 per cent. had been obtained in January, at the end of February the trees still harboured half as many scales as when they were treated. Thus, though the lethal value of the spray was 96·25 per cent., the control value of the spraying by this time was less than 50 per cent., and of no commercial significance.

These trees were kept under observation during the following twelve months, and at no time were they commercially free of the scale. In the following January the average number of scales per fruit on the sprayed trees was 34·8 and the unsprayed 59·4. The sprayed trees were thus a little under 50 per cent. better than they would have been if left unsprayed.

In the second experiment, using the same spray against the red scale during the last week in March, the following figures were obtained:—

Apparent kill fourteen days after application, 97·8 per cent.

Average number of living scales per fruit before application—

Sprayed trees	396·4
Unsprayed trees	259·5

Average number of living scales per fruit at time of third count (that is, six weeks later)—

Sprayed trees	8·9
Unsprayed trees	283·0

Average number of living scales per fruit twelve months later—

Sprayed trees	1·3
Unsprayed trees	181·1

In this case at the time of the second count the figures show a lethal value of 97·94 per cent. and a control value of the spraying of 97·75 per cent. Further, these figures are more than maintained, for the trees at the end of twelve months were more than 99 per cent. better than they would have been if left unsprayed. It should be pointed out that comparisons of two trees over a period of twelve months may not always give valid data. In the interval the scales have been through five complete generations, and it cannot be assumed that conditions of life for the scales on all trees have been the same throughout the period. Red scale reacts quickly to the physiological condition of a tree, and, in turn, profoundly affects that condition; it is commonly found that at any one time parasites are more in evidence in crowded colonies than in sparse ones; the struggle for existence is not necessarily equal—to mention but one fact, it is a habit of red scale that the young settle down in close proximity to the mother, and therefore there must at times be considerable competition for food. However, it is quite obvious from the figures given that the lethal value of a spray and the control value of a spraying are by no means one and the same thing. In the first experiment from a 96·25 per cent. kill the control value in twelve months had become less than 50 per cent., whilst in the second, from a kill of less than 2 per cent. more the corresponding control value was approximately 99 per cent. The differences are caused by reason of the following. January is the month in which effective reproduction by red scale is at its highest, and February is also a period of prolific reproduction. From March onwards to the commencement of spring mortality is great, and reproduction is considerably retarded. Effective reproduction is again in evidence during the spring and early summer, but it is not until mid-summer that infestations multiply very considerably. That some of the trees improve without any treatment, or perhaps without further treatment, is due to several causes. In the first place the kill on the twigs is often better than on the fruit and the fruit is removed during the colder months. With the fruit a certain proportion of the scale is always removed. Natural mortality due to the work of parasites and predators and the influence of climatic conditions also vary. In the case of some of the trees in the second experiment the condition of the tree was certainly of limiting influence. As has been recorded above, red scale affects and is affected by the condition of the tree to a large extent. Thus, in the second experiment the control was such that the trees responded well during the following spring and the vigour improved to such an extent that the suitability of the tree to red scale

infestation was definitely lowered. This, however, cannot be dissociated from the control value of the treatment.

In the third experiment the species was pink wax scale. This is a slow-breeding pest, and control must be established against each of the two generations per annum. The spray in this case was applied approximately a month earlier than the time recommended. At the time of application 72 per cent. of the old scales were reproducing and young were plentiful. It is at such a time that many growers, becoming alarmed at the increase in numbers, apply control measures. In the case of this species the position is very different from what pertains in the case of red scale. There is no overlapping of generations, and the exact position is clear within six weeks or two months after reproduction is in evidence. Counts made on the trees used in this experiment gave the following figures:—

Average number of living young per leaf—

Sprayed trees	16·6
Unsprayed trees	153·0

In this case the migration of young is such an important factor that comparison of figures before and after treatment gives no significant information, and all that can be done is to use trees which are comparable in respect to pink wax infestation. From the above figures it would appear that a kill of 98 per cent. had been obtained. This figure was supported by counts of living and dead old scales, but as old scales fall very readily from the leaf after death the figures are not significant. However, examination of the figures in conjunction with what is known of the life history and habits of the scale show the assumption of a 98 per cent. control to be unwarranted. Many of the leaves on the unsprayed trees carried more than 200 scales, and it is obvious that that number will not survive. The amount of feeding space on the average leaf would not permit more than about half that number of scales to grow to maturity, and the competition for food would certainly be great, even with half the number. On the other hand, on the sprayed trees the maximum number of young on any leaf was twenty-five, and these therefore would have a very good chance of reaching maturity. The most important factor, however, is migration. It would be expected that arrivals from outside would be more likely to become settled successfully on the sprayed leaves where there is ample room than on the already heavily-infested unsprayed ones. The following counts made when breeding had ceased show the actual degree of control—

Average number of living scales per leaf on sprayed trees..	11·3
Average number of living scales per leaf on unsprayed trees	17·8

The drop in average in both cases is due to natural mortality together with the fact that a new growth of leaves had been produced. From the figures it will be seen that there has been a lasting control of about 37 per cent. from a kill estimated at 98 per cent. The actual kill was probably greater than that, since migration had no doubt occurred prior to the counting.

It is obvious from these experiments that in any test there must be a differentiation between lethal effect of the spray and control value of the spraying, and the importance of time of application is made very clear.

[TO BE CONTINUED.]

The Animal Parasites of Domesticated Animals and their Control.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

PARASITISM occurs in both the plant and animal kingdoms, and may be regarded as a type of existence in which one organism—the parasite—is wholly or partly dependent upon another organism—the host—for food and, sometimes, shelter.

Of the many animals whose mode of life might possibly be included under this definition a good number are predaceous, and it is therefore necessary to distinguish between those which are predaceous and those which are parasitic. The demarkation between these two types of existence is at times ill defined, but it may be said that the predaceous animal lives free and, by means of the special cunning and prowess with which it is equipped, is able to snare and capture its prey; whereas the true parasite, in the lazy existence it leads, has no need of these special senses so highly developed in the predaceous animal. Those animals which are predaceous, moreover, devour their prey either whole or piecemeal. The parasite, on the other hand, as a rule, cannot exist once its host is destroyed, and its relations with the host are such that in order to obtain food and shelter from the host its endeavour is to keep the host alive. The praying mantis which captures and feeds on other insects is predaceous, while the various species of lice are parasitic.

Almost every group in the animal kingdom contains species which are parasitic. The range of parasitism extends from associations between host and parasite, in which the parasite may not only do no harm to the host but even at times give certain benefits in return for the food and shelter provided, to associations in which the parasite is distinctly injurious. This latter may be considered as true parasitism.

Such parasites may visit the host only at such times as they require food, and are known as temporary parasites. Bed bugs, fowl ticks, march flies, and mosquitoes are all temporary parasites. Others are dependent on the host not only for food but also for shelter, and are called permanent parasites, such as lice, the sheep ked, the spider or louse flies, and the various species of parasitic worms.

A convenient classification of parasitic animals may be made, depending on whether the parasite exists on the body surface or inside the body. Those found on the body are called external parasites, in contradistinction to which those feeding inside the body are known as internal parasites. Lice, biting flies, &c. are all external parasites while bots and worms are examples of internal parasites.

EXTERNAL PARASITES.

External parasites are all arthropods, or animals possessing six or eight legs. Only a few species of this group are parasitic, however, and, so far as the domesticated animals are concerned, only the *Insecta,* which contains the insects and the *Arachnida,* in which the ticks and mites occur, contain species which are associated with a parasitic life.

INSECTS.

An insect may be readily recognised by the three pairs of legs and by the division of the body into a distinct head, thorax, and abdomen.

The head usually bears a pair of antennæ. The thorax always possesses three pairs of legs and, in most cases, one or two pairs of wings.

With the exception of the bot flies, parasitic insects are external parasites. The parasitic species are confined to the three orders, *Diptera* or true flies, *Anopleura* or lice, and *Siphonaptera* or fleas.

True Flies.

True flies have only one pair of wings, the second pair found in other orders of insects being represented by a pair of rudimentary structures—the balancers. In some parasitic forms the wings may be entirely wanting. The mouthparts are constructed to form a sucking tube which in the parasitic species is modified for piercing purposes as well, enabling the insect to penetrate the skin of the host and suck up the blood and fluids.

The parasitic members of this order include mosquitoes, sandflies, march flies, the stable fly, the buffalo fly, and the spider or louse flies.

Lice.

These are generally small, flattened insects, always without wings, and with some or all of the legs provided with claws. All the members of this order are parasitic in habit.

Lice are divided into two groups—the biting lice (*Mallophaga*) and the sucking lice (*Siphunculata*).

Biting lice have a broad, flattened head which is usually wider than the thorax. The mouthparts are located on the under side of the head and are constructed for biting and chewing only. Biting lice feed on the hair, scales, skin, and feathers, or on such scabby or scurfy material as occurs among the hair or feathers of the host. They do not suck blood or live on blood in any way except when it occurs on the skin surface through the host biting or scratching itself. Biting lice are most usually to be found on birds, though nearly all domesticated animals harbour some species.

Sucking lice are usually larger than biting lice, and the head is elongate and pointed. In this sub-order the mouthparts are of the piercing and sucking type, and the louse lives on the blood and fluids of the host. Sucking lice are found on mammals only, and are not known to occur among birds.

Fleas.

The members of this order have the body compressed laterally, and are usually very small in size and dark brown in colour. The mouthparts are adapted for piercing and sucking, and the insect lives on blood. There are no wings. The legs are well developed, especially the posterior pair, which are long, powerful, and adapted for leaping which is the normal mode of progression among these insects.

The adult flea spends most of its lifetime upon the host, but the other stages in the life cycle occur off the host and usually in the soil or other suitable places.

The Life Cycle of Parasitic Insects.

Among the parasitic insects two distinct types of life cycles are observed. In the case of lice the female glues her egg to the hair or

feathers of the host. In time this egg hatches to give rise to a tiny louse not unlike the parent in general appearance but much smaller in size and not sexually mature. After feeding for some time the small louse casts its skin, and the second phase in the life cycle is reached. This is larger in size and more like the adult in appearance. Further moults or skin castings take place, and eventually the sexually mature adult appears.

With the flies and fleas, on the other hand, the egg hatches and a small elongate segmented larva appears. This stage feeds and grows and, in time, forms the "pupa" which may lie motionless in the soil or be actively swimming, as in the case of mosquitoes. When the larva is fully grown it shrinks and the outer larval skin hardens and usually turns brown. In this pupa the larval tissues are broken down and reformed to produce the adult fly which, in time, emerges and commences its life. Thus there are four stages, each of which is entirely different to the others, namely, the egg, larva, pupa, and adult.

ARACHNIDA.

This group includes, besides the mites and ticks, the spiders and scorpions as well. They are distinguished from insects by the adult's four pairs of legs, the insect having only three pairs. In the spiders and scorpions the body is divided into two distinct portions one of which is the abdomen. The other division is known as the cephalothorax, and is formed by the fusion of the head and thorax.

In the mites and ticks the head, thorax, and abdomen are so fused together that there is no distinct division of any sort. It is only these two groups which contain parasitic species.

Ticks.

All ticks are parasitic and are to be found on a very wide range of animals. In general these are flattened and oval in appearance, and on engorgment with blood may attain a very conspicuous size. The mouthparts are usually placed at the narrower and anterior end, and consist of a pair of mandibles which enable the tick to pierce the skin of the host. Once the skin is pierced a club-shaped structure with rows of recurved teeth is then inserted. This maintains the tick in position and allows it to hang free on the body. Ticks suck blood, preventing its coagulation by injecting an anti-coagulating fluid into the wound.

The life cycle of the tick is very similar to that of the louse in that a series of moults are required before the adult stage is reached. The eggs are always laid in some sheltered spot on the ground. The young tick that emerges is peculiar in having only three pairs of legs in comparison to the adult's four pairs. The larva, on finding its host, engorges and then moults to form the nymph. This stage then, in turn, engorges and moults, sometimes to give rise to a further nymphal stage, but more usually to the adult. The moults may occur on the ground or on the host, in the former case, the new phase finding a new host in the manner of the larva.

Mites.

The great majority of mites are free living. Many species are injurious to economic plants; some are predaceous and the number parasitic on animals is comparatively small. These parasitic species are

very minute in size, the largest of them being no bigger than a pin's head. They differ from ticks in many ways, but are readily recognised by their small size and the absence of the holdfast structure with its recurved teeth so characteristic of ticks. Some species live on the surface of the skin, others beneath the skin, in most cases a mange condition arising as a result of the irritation.

Here, also, there are egg, larval, nymphal, and adult stages, as in the case of ticks, but with few exceptions the whole life cycle is spent on the host. Some species—our scrub-itch mites, for example—are parasitic only in the six-legged larval stage, the remaining stages in the life cycle being generally predaceous.

INTERNAL PARASITES.

With the exception of the bot flies, whose larvæ are found in the nasal cavities of sheep, in the stomach of horses, and, in other countries under the skin of cattle, internal parasites consist almost entirely of worms, or *Helminths.* These may be readily divided into Flatworms and Roundworms, the Flatworms comprising the flukes and tapeworms.

FLUKES.

The flukes, or *Trematoda,* are generally flattened, leaflike, or sometimes conical worms. Suckers are always present, but vary in size and position according to the species. At the anterior end is the mouth which is surrounded by the oral sucker. There is a modified digestive system present, but rather peculiarly there is no anal opening. With few exceptions flukes are true hermaphrodites, and each individual may contain a complete set of both male and female genital organs. Flukes may occur in the alimentary canal, liver, lungs, and various other parts of the body.

Life History of Flukes.

The eggs reach the exterior in the body excretions—usually the dung. Here, under suitable conditions, they hatch into a small motile organism which must then bore its way into a snail before any further development can take place. After some time spent in the snail it is usually then ready to infect its host and, breaking out from the snail, reaches the open and is swallowed by the host in food or water. The snail is known as the intermediate host. In some species a second intermediate host is required.

TAPEWORMS.

Tapeworms, or *Cestodes,* as their popular name implies, are like a piece of tape in appearance, being elongate and flat. The body consists of a chain of segments which becomes very narrow towards the anterior end, which bears the very small head. Some species may attain a length of 25 feet or more, and others are so small as to be seen with difficulty with the naked eye. The head is usually provided with suckers, and is sometimes furnished with hooks, both of which enable the worm to attach itself to the wall of the intestine. There is no digestive system in the sense of a mouth, intestine, &c., the food being absorbed by the body surface. Each segment is an entirely separate identity so far as its sexual life is concerned, being provided with both male and female organs. Tapeworms usually occur in the intestine, and only a very few species are found in other parts of the body.

Life History of Tapeworms.

Of the many hundreds of species of tapeworms that have been recorded from different hosts, the life histories of very few are completely known. In all these instances, with only a single exception, an intermediate host is required to complete the life cycle. As an example, the life history of the hydatid tapeworm may be considered. The adult hydatid tapeworm is found only in the small intestine of the dog and other closely related animals such as the wolf. The dog is known as the primary host. The eggs of this adult tapeworm reach the exterior in the fæces of the dog, and in some way or other are swallowed by man, sheep, cattle, &c., all of which are intermediate hosts. The egg hatches in these intermediate hosts and gives rise to a tiny larva which then makes its way to various parts of the body, usually the liver or lungs. In these organs it then develops into a bladder-like object containing fluid. This is the larval tapeworm. No further changes take place in the intermediate host, but if organs containing these bladders are fed to the dog the adult tapeworms eventually appear in the small intestine. In this case it has been shown that many animals may act as suitable intermediate hosts but, with other tapeworms, the intermediate host range may be limited to one or very few—the beef tapeworm of man, for example, has only one intermediate host, the larval stage being found in cattle.

ROUNDWORMS.

Roundworms, or *Nematoda*, are elongate and round. There is a mouth and intestine, and the sexes are usually separate, there being male and female worms. Of the many thousands of roundworms known the majority are free living; some species do serious damage to plants and others are parasitic in animals.

Life History of Roundworms.

Like flukes and tapeworms, roundworms cannot multiply and increase inside the body, and their numbers in a host can only be augmented by the host taking in the infective stage which occurs outside the animal.

The female roundworm produces eggs or larvæ which reach the exterior principally in the fæces. Under suitable conditions the egg may develop into an infective stage, when it contains a tiny worm, or the egg may hatch outside the body, and the larva, after a certain period of development becomes infective. The infective stage, whether egg or larva, on gaining access to a suitable host, grows to the adult stage. In other cases an intermediate host is necessary, the egg or larva in the dung being eaten by a beetle or a fly or some other small animal, the adult form being reached only when the beetle, &c., is eaten by a suitable host.

THE HOST RANGE OF PARASITES.

In the case of such temporary parasites as march flies, mosquitoes, sand flies, &c., a large number of different kinds of animals act as suitable hosts. The various species of ticks usually favour one kind of animal on which they find conditions most suitable for their development, but may occasionally attack and live on other animals. The majority of the many kinds of ticks usually get their popular name from the animal on which they most frequently are seen. Thus we have the cattle tick, the dog tick, the kangaroo tick, &c. But the cattle tick sometimes occurs

on horses, sheep, and dogs, and the dog tick on cattle and cats, and so on.

Mites and lice, however, appear more restricted, and, as a rule, can exist and increase only on the one species of host. The various mange mites may transfer themselves from one species of animal to another and, although they may live for some little time on the second animal, do not succeed in establishing themselves. Similarly, with perhaps only one or a very few exceptions, the lice that occur on one animal are never found infesting a different species of animal.

In the case of worms it may be said that unless the animals are closely related species it is unusual, under natural conditions, to find the worms of one host species occurring in another. The worms found in sheep, for example, are frequently observed in cattle and goats, but do not infest horses or pigs. Poultry worms are restricted to poultry, and probably some of the species of wild birds, and never occur in pigs, &c. Similarly, it is most unlikely that our marsupials would play any great part as hosts and distributors of the worm parasites of any of our domesticated animals.

THE ECONOMIC IMPORTANCE OF PARASITES.

Generally speaking a few parasites cause little harm to the host, but when the infestation is heavy serious disturbances to the health of the host may result.

External parasites pester and irritate. They may not only considerably weaken the host through the loss of blood, but their presence results in a loss of nervous energy with a consequent interference with nutrition. Heavily infested animals will not fatten, and young animals may remain stunted.

External parasites are also important as vectors or carriers of the organisms of serious diseases. The fowl tick, for example, may transmit fowl tick fever, and the cattle tick cattle tick fever. Mosquitoes carry malaria and fleas carry bubonic plague. Others act as intermediate hosts for harmful worm parasites, one of the best examples being the mosquito which carries the larvæ of *Wauchcria bancrofti*, the cause of filariasis in man.

The effect of internal parasites upon the host depends not only upon the numbers present but also upon the tissues infested and the habits of the species. Those species lying free in the alimentary canal are, comparatively speaking, the least harmful. These may rob the host of food, cause mechanical obstructions, and irritate the lining of the stomach and intestines. Blood-sucking species are distinctly harmful, and may produce an acute anæmic condition. Then there are species which invade and destroy tissues vital to the host's wellbeing, resulting in a stunted and unthrifty animal. All worms, moreover, are considered to produce toxins which are highly poisonous substances and which may be absorbed into the host's body with serious effects.

THE CONTROL OF PARASITIC INFESTATIONS.

The control of any parasitic disease involves three distinct steps—

(1) A knowledge of the various symptoms of parasite presence and of the species of parasite concerned;

(2) The application of an efficient method of treatment; and

(3) The adoption of certain measures to prevent reinfestation or to keep it below the point at which it becomes harmful.

(1.) Parasitic infestation is usually associated with certain symptoms which, however, do not as a rule become prominent until the infestation has become serious. These symptoms are dealt with in detail under the several species of parasites described herein.

Suspecting parasite presence from the symptoms manifested, the stockowner must now take steps to find out which species of parasite is concerned. This is important, because without such an examination an efficient treatment cannot be given. In the case of such external parasites as lice, fleas, and ticks, an examination of the skin surface makes the cause of the irritation at once apparent. With mange diseases, on the other hand, it is necessary to have skin scrapings examined at a laboratory, not only for a correct diagnosis of the disease condition, as skin diseases similar to mange in appearance are not always caused by mange mites, but also in order to obtain a correct identification of the species of mite, as the treatment depends largely on the species of mite causing the disease. Similarly, with the red mite and feather mite of poultry, a correct identification is essential for efficient treatment, for fowls infested with feather mites must be dipped, whereas red mite control does not require such treatment.

In the case of worms, also, a determination of the species causing the outbreak is necessary, for drugs which will remove hookworms, for example, are not effective against tapeworms. The method of diagnosis depends largely upon the number and value of the animals infested. With animals of relatively small value one or two of those showing pronounced symptoms should be killed and a careful examination made of all the internal organs and tissues, paying particular attention to the stomach, small intestine, large intestine and blind gut, liver, and lungs.

Should the stockowner not wish to sacrifice any animal for such an examination, he may be able to secure specimens of the parasite by carefully watching the dung, in which worms in cases of heavy infestation are sometimes passed in numbers. He may also avail himself of the assistance given by the laboratory, where by an examination of a sample of dung or other excretions the eggs or larvæ of the parasite may be detected.

It is always advisable to send in all specimens of external or internal parasites to the laboratory for a correct identification. This not only ensures that the treatment will be the most efficient available, but it is also of great assistance in enabling the laboratory worker to obtain very necessary information on the distribution, prevalence, &c., of any parasite.

(2.) For external parasite control various liquids, powders, and oils are available. For lice and ticks of cattle, horses, and sheep an arsenic solution is applied, usually in the form of a dip, though when only a relatively few animals are to be treated the solution may be used as a spray. For lice and fleas on small animals powders such as pyrethrum and sodium fluoride are suitable. Mange conditions and isolated confined lice infestations may be held in check by oils. Oils also usually form the base of repellents for lessening the severity of sandfly or march fly attack.

If carefully carried out one treatment may be depended upon to kill most if not all the parasites, but is usually not so effective against the egg. For the best results, therefore, at least two treatments are necessary. The second treatment should be delayed long enough to give these eggs sufficient time to hatch, but the interval must be such that no opportunity is given any parasite hatching from these unaffected eggs to reach maturity and lay further eggs.

For the removal of internal parasites various drugs are available which may be administered either in liquid form or in capsules. These drugs are all poisons and great care should be given their use. No more than the recommended dose should be given, and, to avoid any possibility of mistakes in mixing or dosing, a few animals should be treated a few days before the flock or herd and carefully watched for any ill results.

There is no drug known which can be depended upon to remove all worms after a single dosing. At least two treatments should be given after an interval sufficient to permit the animal to recover completely from the first. Where the infestation is heavy and continuous full advantage of even a highly effective drug only follows many treatments made at regular intervals throughout the year.

Individual treatment will always give best results, and attempted administration of remedies in food, drinking water, and licks is not advised unless in exceptional circumstances. The treatment of every member of a flock of poultry, for example, is regarded in many quarters as costly and impracticable, and here mass treatment by means of drugs in the food is frequently recommended.

Starvation for some time before the drug is administered is usually necessary. This allows better contact of the drug with the worm which would otherwise be protected to a large extent by the partly digested food.

(3.) Treatment is of little value, no matter how effective, so long as the animal can readily become reinfested. In the case of the worm parasites, it has already been pointed out that these cannot breed and increase inside the animal, and that the only way in which an animal can become infested is from the soil, water, or some intermediate host infected with a phase in the life history spent outside the animal. As this external phase originates in the body excretions, usually in the dung, worm parasite control can only be accomplished by cleanliness and sanitation. This is especially desirable in the case of such closely confined animals as poultry, pigs, and horses. As a rule, also, the free-living stages cannot develop in the absence of moisture. Therefore, regular removal of all dung, dry, clean conditions, and the adoption of measures to keep all food off the contaminated ground are essentials for worm parasite control.

Where animals such as sheep and cattle are concerned the draining and rotation of pastures and burning-off at certain times of the year is advisable.

Another control measure which may sometimes be adopted is the spelling of land for such a period that the free-living stages will have all succumbed.

When it is pointed out that efficient drugs are known only for a comparatively few species of the many worms that occur in domesticated

animals preventive measures assume an extremely important position, and the stock owner should take every step to see that they are observed so far as practicable.

Sanitation is also necessary for external parasite control, for not only is it concerned with the breeding places of such pests as fleas and mosquitoes but it also prevents to a certain degree the spread of lice and mites.

As young animals are more readily affected by parasite presence than old animals special care should be taken in the application of any measure which will prevent infestation to any extent. They should always be kept away as much as possible from the older animals and the contaminated ground on which these have been running.

Finally, it may be said that as nutrition probably plays an important part in the ability of the animal to resist the effects of infestation some thought should be given this phase of control. It has been found, for example, that in the case of sheep top-dressing of the pastures and the provision of suitable licks will enable the sheep to resist worm infestation to a conspicuous extent.

QUEENSLAND SHOW DATES, 1934.

July.

Bowen, 4th and 5th
Gatton, 4th and 5th
Kilcoy, 5th and 6th
Ayr, 6th and 7th
Townsville, 10th to 12th
Woodford, 12th and 13th (Sports only)
Rosewood, 13th and 14th
Cleveland, 13th and 14th
Cairns, 17th to 19th
Charters Towers, 18th and 19th
Caboolture, 20th
Barcaldine, 24th and 25th
Nambour, 18th and 19th
Atherton, 24th and 25th
Esk, 27th and 28th
Pine Rivers, 27th and 28th

August.

Royal National, 6th to 11th
Home Hill, 31st August and 1st September

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Pomona, 12th and 13th
Innisfail, 14th and 15th
Mareeba, 20th and 21st
Beenleigh, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Southport, 5th
Millaa Millaa, 5th and 6th
Tully, 12th and 13th

The Determination of Larval Instars and Stadia of Some Wireworms (Elateridæ).

By W. A. McDOUGALL, Assistant Entomologist.

SOME three years ago the writer visited Mackay in order to undertake a comprehensive investigation of the wireworm pests of sugar-cane in Central Queensland. This investigation had not proceeded far before it was realised that it was necessary to have more exact information than was available on methods of determining the larval instars of wireworms, as a means to determining, in turn, the larval stadia. Considerable attention was accordingly given to this work. In the course of the past three years, over thirty different species of Elaterid larvæ have been collected in the area embraced by the investigation. Of these species, one was taken from the rotted wood on the damp lee-side of a tree stump, another from under bark, but the remainder were soil inhabitants. The wood-inhabiting species, and three of the soil species, were of the brown cylindrical type of larva with the ninth abdominal segment either simply rounded at the apex or gradually tapering to a point. Of the remaining species, all were of the yellowish semi-flattened Elaterid larval type with specifically shaped ninth abdominal segments with processes. Included in this latter group is *Lacon variabilis* Cand.; as this species is considered (9) to be the most serious wireworm pest of sugar-cane in the areas mentioned, its life cycle and habits have been observed in as much detail as possible. At the same time, the methods employed in the study of its life cycle and habits have been applied to those of other Elateridæ (mainly, but not exclusively, species of the same larval type that inhabit cultivated fields) for the purpose of checking the reliability of these methods, and also for comparing and contrasting the larval periods and general behaviour of these species with *L. variabilis*.

A. HISTORICAL.

Although the larvæ of a number of Elateridæ of economic importance have been studied, there are few published accounts of a detailed nature dealing with the length of the complete larval period or with larval instars and their stadia. Many of the workers, such as Graf (6) and Ford (5), have had to deal with pest species of wireworms which evidently require two to five or more years from egg to pupation, according to the particular species. The lengths of the larval periods have usually been estimated from observations, chiefly on the sizes of the larvæ found in the field at different times of the year, and the observed rates of growth of some of the different sized larvæ in captivity. The number of larval instars of any species has never been accurately ascertained, and very few species have been taken through from egg stage to adult.

From a survey of literature relevant to this phase of "wireworm" work, it appears that larval length is the usual criterion upon which the larvæ of any species are differentiated into groups, and this grouping is as far as most investigators have proceeded. Ford (5), after working with *Agriotes obscurus* Linnaeus, stated that many of the smaller stages

taken in one year, from July to October, varied much in size, and it was found that after about two months a number of these apparently small specimens were really of medium size. It therefore appeared to him that the breadth might be a safer criterion of age than length. Graf (6), although not successful in working out the number of larval instars of *Limonius californicus* Mannh. on account of the unsuitability of the available rearing apparatus, found the increase in the width of the head to be the best indication of an ecdysis.

Various authors have made observations on the growth rates of some species of Elaterid larvæ at different stages during larval life. Graf (6) found there were indications that *L. californicus* moulted five or six times during a larval life calculated to extend a trifle over three years. Larvæ grew rapidly during the first two or three weeks after emerging from the eggs, but this was the only time during their long larval period when growth was apparent. To Veitch (17), the moults of *Simodactylus cinnamoneus* Boisd. appeared to be of frequent occurrence and, in the older wireworms in the laboratory, they might be expected to occur once every eight to twelve weeks. The complete larval life was considered to extend over two or three years; growth rate of the young wireworms was found to be very slow. Ford (5) thought the larvæ of *Agriotes obscurus* passed through three stages, limited by three moults, and were full grown at the end of three years. There is then a period of active feeding, followed by a quiescent condidition and terminating in pupation; total length of larval period was computed at four years. The rate of growth was found to be so uniform as to suggest that the curve of growth would be fairly continuous rather than irregular. Roberts (15) found *Agriotes* spp. to moult twice a year, and the rate of growth of the first stage larvæ to be very slow. The earlier estimate of five years for the larval stage of *A. obscurus* is considered to be approximately correct. Mesnil (11), who studied a number of wireworms in France, found that all seemed to have lengthy larval stages, and the larval period of *A. sputator* L. was calculated to be three years. The growth rate of the earlier instars was found to be extremely slow. Fenton (4) found that the growth of two species of *Melanotus* was very slow during the first year of larval life and that, during that time, one moult took place. Conradi and Eagerton (3) give the average periods occupied by the different stages of *Monocrepidius vespertinus* Fab. as twelve days for the egg, 305 for the larval, and thirteen for the pupal stages. In Hawaii (16) *Monocrepidius exsul* is thought to have a larval period of one year or more. Unfortunately no references are made to the growth rates of any of the larval instars of these two *Monocrepidius* species.

B. DETERMINING LARVAL INSTARS.

Various possible criteria for the grouping of larvæ of *Lacon variabilis* were investigated during the course of the rearing work with a view to enabling definite determination of instars. These included the following:—

1. Length of larvæ.
2. Greatest width of ventral mouth parts.
3. Antennal segment ratios, and other mouth part measurements.
4. Width of head capsule.

5. Time of feeding of an instar.
6. Appearance of an instar prior to an ecdysis.
7. A peculiarity in the shape of the first instar.

The results which were obtained are discussed under these headings, and this is followed by a brief discussion of Dyar's Law in its application to the larvæ of *L. variabilis*. A short account is also given of similar work which was carried out to some extent with the other species found.

During the last three quarters of 1931 approximately 1,200 larval specimens of *L. variabilis* were taken from cane fields; of these 306 were used for rearing purposes, and 219 adults were obtained from them between October and the end of that year.

Length of Larvæ.

Numerous measurements of length were taken at monthly intervals during the rearing of the larvæ (Table I.), but apart from serving as a general guide to the probable stage of development they were of little value. The chief result accruing from this rearing work was the correlation of the larva with its correct adult. After length measurements had failed to provide a method for the working out of the details of the larval life with the degree of precision desired, further search was made for criteria suitable for the purpose, as outlined.

Greatest Width of Ventral Mouth Parts.

The ventral portion of the mouth parts of an Elaterid larva is a conspicuous structure situated in a large depression on the venter of the head Plate 1, figs. A and B).

This structure is formed by the fusion of the stipites of the maxillæ with the mentum (Plate 1, fig. E [a]). In some genera (e.g., B. sp.) the mentum is quadrilateral and much longer than wide; in these instances more of the cardines are visible when the whole of the ventral mouth parts is retracted than is so with *Lacon* spp. and *Heteroderes* spp., each of these possessing a triangular mentum. A total of 229 larvæ of different sizes was examined, and it was found that these could be grouped according to the greatest width of the ventral mouth parts, i.e., the measurement (A-B) illustrated in fig. A of. Plate 1. In a number of instances this grouping (Table II.) disagreed with the grouping as obtained when the same larvæ were separated on the basis of length. The groups obtained by this means were well defined, there being no individuals with intermediate measurements which might equally well be placed in two groups. During 1931 several larvæ, which had just shed their skins, had been preserved with the exuviæ which had been found near them. The (A-B) [b] measurements of the mouth parts of these larvæ and their respective exuviæ were taken, in the manner described above. Each exuvium measurement was within the limits of the group immediately preceding that into which a similar measurement of the correctly-related larva fell.

(*a*) This drawing represents one section of a complete serial section of a sixth instar. The block was prepared by the double embedding in celloidin and paraffin (adapted from Guyer: Animal Micrology, Revised Edition, p. 64) of the instar immediately after ecdysis; the larva was completely white with the exception of the tips of the mandibles, which were brown.

(*b*) For the sake of convenience the greatest width of the ventral mouth parts is termed the (A-B) measurement both in the text and tables.

TABLE I.

LENGTHS OF LARVÆ IN CENTIMETRES; DATA BASED ON THE RECORDED OBSERVATIONS ON 306 LARVÆ AND 3 PUPÆ, MADE DURING REARING WORK, 1931.

Lab. No. of Larva and Pupa.	Dates of Observations. 14th May	5th June	22nd June.	6th July.	5th Aug.	9th Sept.	28th Sept.	Oct.	Nov.	Dec.	Jan. (1932).
P. 2 ..	P.f.		Adult 19th May.								
L. 2 ..	Length ·58 cm.	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	e. Ex. f. ·9 cm.	e. Ex. f. 1·2 cm.	..	Adult (17th)	..	..
L. 19 ..	1·45	p.n.c. n.e.	1·7	e.h. 1·6	n.e. 1·7	e.h. 1·9	n.e.	n.e.	P.f. (17th) Adult (29th)	..	..
L. 23 ..	1·1	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	n.e. Ex. f. 1·1	e.h.	e.h. Ex. f. 1·5	n.e. 1·7	P.f. (17th) Adult (24th)	..	..
L. 31 ..	1·0	n.e. Ex. f. 1·4	p.n.c. e.h.	n.e.	n.e.	e.h. Ex. f. 1·5	n.e.	n.e.	P. f. (17th) Adult (30th)	..	..
L. 40 ..	1·5	e.h. 1·6	p.n.c. n.e. 1·74	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	P.f. (12th) Adult (21st)	..	..	..
L. 47 ..	1·9	p.n.c. e.h. ..	p.n.c. n.e.	p.n.c. n.e.	Just changed Ex. f.	e.v.h. 1·86	e.h. Ex. f. 1·94	..	P. f. (17th) Adult (22nd)	..	..
L. 52 ..	1·1 ..	p.n.c. n.e.	p.n.c. n.e.	..	p.n.c. n.e. 1·1	e.v.h. 1·4	p.n.c. 1·5	e.h. Ex. f. 1·7	P.f. (17th) Adult (21st)	..	..
L 70 ..	·77	e.	..	..	Ex.f.	e.h. 1·2	e.h. 1·3	e.h. 1·6	p.n.c. n.e.	P.f. (27th)	Adult (8th)
L. 81 ..	1·9	e.v.h. Ex.f.	n.e. p.n.c. 1·9	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	In a cell	P.f. (12th) Adult (17th)	..	..	..
L. 87 ..	·83	h.e. Ex.f. 1·0	p.n.c. n.e.	n.e.	n.e.	e.v.h. 1·6	1·7	e.v.h.	P.f. (17th) Adult (29th)	..	..

L. 88 ..	1·9	Just changed Ex.f.	e.v.h. 1·9	n.e.	n.e.	n.e.	n.e.	1·8	..	P.f. (8th) Adult (10th)	..
L. 90 ..	1·7	e.v.h. Ex.f. 1·9	1·9	n.e.	Just changed n.e. Ex.f.	e.v.h.	2·0	.	P.f. 2nd Adult (15th)	..	..
L. 120 ..	Taken from field 27th May 1·6	..	e.v.h. Ex.f. 1·6	1·9	..	Nearing an ecdysis	e.v.h. 1·9	..	..	P.f. (6th) Adult (8th)	..
Ls. 140 to 145		..	.. ..	Taken 10th July 1·7	p.n.c. n.e.	.. ..	..	1·6 to 1·7	..	P.f. (17th) Adults (20th to 25th)	..
L. 152 ..	..	..	..	1·3	Ex.f. 1·5	e.v.h.	Ex.f. 1·6	e.v.h.	..	P.f. (10th) Adult (21st)	..
L. 161 ..	..	..	..	1·9	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	P.f. (2nd Adult (10th)	..	..
L. 205 ..	.. ..	..	..	1·9	p.n.c. n.e.	e.v.h. Ex.f. 2·0	..	..	P.f. (2nd) Adult (10th)	..	..
L. 230 ..	..	..	..	2·1	p.n.c. n.e.	p.n.c. n.e.	p.n.c. n.e.	..	Adult (17th)	..	..
L. 255 ..	..	..	..	Taken 27th July very small	e.h.	1·3	e.	e. 1·6	e.v.h. Ex.f. 1·6	e.v.h.	P.f. (8th) Adult (10th)
L. 256 ..	..	..	..	Very small	e.h.	1·0	e.	e.v.h. 1·45	e.v.h.	P.f. (18th) Adult (20th)	..
Ls. 295 to 301	..	..	..	..	..		..	Taken 14th Oct. 1·6—2·1	Adults (17th-28th)	..	..

p.n.c. = probably no change; n.e., e., e.h., e.v.h. = not eaten, eaten, eaten heavily, or eaten very heavily, of potato tuber since last inspection (fresh potato tuber supplied after every inspection). Ex.f. = exuvium found; P.f. = pupa found.

TABLE II.—MOUTH PART MEASUREMENTS OF SIX GROUPS OF LARVÆ.

Group.	Number of Larvae Measured.	Greatest Width of Ventral Mouth Parts. (In mm.)		
		Minimum.	Mean.	Maximum.
A	5	·35	·38	·40
B	10	·47	·52	·54
C	68	·63	·68	·70
D	60	·79	·83	·86
E	29	·96	·99	1·03
F	57	1·12	1·15	1·24
Total	229	..	..	..

In December, 1931, and January, 1932, approximately 1,000 eggs of *L. variabilis* were obtained from adults bred from larvæ during 1931 and from other adults collected in the field. From these eggs many larvæ emerged and were used for rearing purposes. With the rearing apparatus in use at that time the majority of the exuviæ from the younger instars could not be recovered from the soil in the rearing jars. However, the (A-B) measurements of 179 small instars were taken; at the time of measurement some of those larvæ had just emerged from eggs. Again, grouping could be effected, and the details are given in Table III.; obviously groups J and K contain larvæ similar to those represented by groups A and B respectively of Table II. It would seem, therefore, that any larva of *L. variabilis* can be placed, according to its (A-B) measurement, into one of eight groups.

TABLE III.—MOUTH PART MEASUREMENTS OF FOUR GROUPS OF LARVÆ.

Group.	Number of Larvae Measured.	Greatest Width of Ventral Mouth Parts. (In mm.)		
		Minimum.	Mean.	Maximum.
G	89	·161	·163	·167
H	50	·21	·23	·28
J	27	·35	·38	·40
K	13	·47	·53	·54
Total	179	..	..	..

The percentage loss by death in rearing young larvæ up to the fourth group (Group K of Table III.) was exceptionally heavy during 1932. Varying environmental conditions were tried, and when a suitable set of conditions was found, 134 larvæ were reared from eggs to

TABLE IV.

(A–B) MEASUREMENTS AS DETERMINED FROM THE RECORDED OBSERVATIONS OF 134 LARVÆ.

Laboratory No. of Larva.	Egg Laid.	First Instar.		Remarks on any Intermediate (A–B) Measurements and Ecdyses.	Ecdyses Observed.														Date of Appearance of Adult.	Length of Complete Larval Period (in days).
		Date of Emergence.	(A–B) Measurement.		Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.		
L1. 1	8 i.	16 i.	·163	Larvæ with (A–B) measurement of ·65 on 8 iii.	..	..	..	12 iii.	·65	·79	29 iv.	·79	·98	1 vi.	·98	1·14	1 x.	1·14	16 x.	259
L1. 3	8 i.	16 i.	·162	Larvæ with (A–B) measurement of ·54 on 16 ii.	20 ii.	·54	·67	8 iii.	·67	·84	1 v.	·84	1·03	21 vi.	1·03	1·24	30 x.	1·24	14 x.	288
L1. 6	8 i.	16 i	·166	Found on 24 ii. an exuvium with (A–B) measurement of ·35; on 27 ii. (A–B) measurement of larvæ was ·47	2 iii.	·47	·63	10 iv.	·63	·79	25 v.	·79	·98	29 vii.	·98	1·20	1 xi.	1·2	16 xi.	290
L2. 2	10 ..	18 i.	·167	..	..	..	..	25 iv.	·65	·82	6 vi.	·81	·98	4 vii.	·98	1·16	23 xi.	1·16	7 xii.	310
L2. 3	10 i.	18 i.	·161	Larvæ with (A–B) measurement of ·53 on 18 ii.	19 ii.	·53	·67	4 iii.	·67	·84	15 iii.	·84	(Pupa)	..	..	..	..	..	29 iii. ♂	57
L2. 5	10 i.	18 i.	·163	..	..	..	..	24 ii.	·65	·80	4 iii.	·81	·98	..	..	..	26 iii.	1·16	9 iv. ♀	68
L2. A1	28 i.	6 ii.	·167	Two ecdyses recorded. (A–B) measurement 12 iii. (Ex. ·26) (L. 39); 28 iii. (Ex. ·39) (L. 51)	30 iv.	·51	·65	4 vi.	·66	·81	26 viii.	·81	·98	7 x.	·98	1·12	24 xi.	1·12	10 xii.	292
L2. 26	1 ii.	9 i.	·161	Ecdyses recorded on 12 iii. (Ex. ·237) (L. ·373)	..	..	..	1 v.	·63	·82	1 vi.	·82	1·02	28 vii	1 02	1·25	14 xi.	1·25	29 xi.	279
L22. 11	29 i.	7 ii.	·164	Larvæ with (A–B) measurement of ·51 on 28 iv.	5 v.	·51	·63	18 vi.	·63	·79	1 ix.	·79	·98	1 x.	·98	1·15	12 xii.	1·15	Found Adult, 8 ii. 1933	..
L22. 17	29 i.	7 ii.	·164	Larvæ with (A–B) measurement of ·51 on 8 iii.	20 iii.	·50	·65	10 v.	·65	·86	5 vi.	·86	1·03	20 vii.	1·03	1·20	9 i. 1933	1·20	24 i., 1933	337
L22. 18	29 i.	7 ii.	·165	[Recorded an ecdysis on 20 iii. (Ex. ·25) (L. ·39)	24 i.	·51	·65	1 v.	·65	·84	1 vi.	·84	·98	30 vii.	·98	1·16	26 x.	1·16	10 xi.	262
L22. 22	30 i.	8 ii.	·163	Larvæ with (A–B) measurement of ·49 on 15 v.	25 v.	·49	·65	26 vi.	·65	·86	24 viii.	·86	·98	26 x.	·98	1·20	25 xi.	1·20	9 xii.	291
L22. 23	30 .	8 ii	·163	Larvæ with (A–B) measurement of ·49 on 1 v.	14 iv.	·49	·63	5 v.	·63	·81	6 vi.	·81	1·03	24 vii.	1·03	1·20	26 x.	1·20	9 xi.	261
L22. 26	8 ii.	16 ii.	·161	Larvæ with (A–B) measurement of ·65 on 29 iii.	..	..	..	5 iv.	·65	·82	24 v.	·82	1·03	1 vii.	1·03	1·17	28 x.	1·17	11 xi.	255
L7. A8	1 ii.	9 ii.	·161	Recorded the ecdysis (Ex. ·25) (L. ·37)	..	..	..	4 iii.	·67	·82	30 iv.	·82	·98	1 vii.	·98	1·14	14 xi.	1·14	30 xi.	279

L1. 1, L1. 3, and L1. 6 are larvæ from eggs of adult L1. L22 only, represents more than one female confined in the one cage.

* ±) 2 days; in many instances the date is exact.

TABLE V.

(A–B) MEASUREMENTS IN MILLIMETRES AS DETERMINED FROM THE RECORDED OBSERVATIONS ON 117 LARVÆ.

Laboratory No. of Larvæ.	Date when Collected from Field.	(A–B) Measurement on Date of Collection.	Ecdyses Recorded.															Date of Appearance of Adult.
			Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.*	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date *	(A–B) Measurement of Exuvium.	Pupa.	
128	19 April	·96	..	..	..	..	..	..	..	..	..	15 May	·96	1·16	19 Dec.	1·16	..	..
169	19 April	1·17	..	..	..	..	..	..	..	..	..	..	..	..	10 May	1·17	..	25 May
132	19 April	·65	..	..	..	27 April	·65	·86	21 July	·86	1·03	21 Oct.	1·03	1·21	1 Dec.	1·21	..	17 Dec.
134	19 April	1·17	..	..	..	..	..	..	..	..	..	..	..	..	8 May	1·17	..	22 May
135	19 April	1·03	..	..	..	..	..	..	..	..	..	1 June	1·03	1·16	1 Nov.	1·16	..	16 Nov.
146	19 April	·51	25 April	·51	·70	15 May	·70	·86	1 June	·86	·98	1 July	·98	1 16	25 Oct.	1·16	..	9 Nov.
150	19 April	1·16	..	..	..	..	..	..	..	..	..	..	..	..	?	1 16	.	Found Adult, 2 June
158	19 April	·47	20 May	·47	·67	1 July	·67	·82	15 Sept.	·82	·98	15 Oct.	·98	1·15	28 Nov.	1·15	.	12 Dec.
169	24 May	·65	..	..	..	20 June	·65	·82	21 July	·82	1·00	20 Aug.	1·00	1·16	25 Oct.	1·16	..	10 Nov.
182	1 June	†·39	28 Aug.	·51	·65	12 Oct.	·65	·82	30 Oct.	·82	·98	14 Nov.	·98	1·15	28 Nov.	1·15	..	13 Dec.
183	10 June	·96	..	..	..	..	..	..	..	..	..	15 June	·96	1·14	14 Nov.	1·14	.	30 Nov.
184	22 June	1·00	..	..	..	..	..	..	..	..	..	24 June	1·00	1·26	25 Oct.	1·26	..	9 Nov.
185	22 June	1·15	..	..	..	..	..	..	..	..	..	..	..	..	5 Nov.	1·15	..	20 Nov.
186	22 June	·98	..	..	..	..	..	..	..	..	..	20 July	·98	1·16	14 Nov.	1·16	.	29 Nov.
187	22 June	·96	..	..	..	..	..	..	..	..	..	20 Aug.	·96	1·12	14 Nov.	1·12	..	28 Nov.
190	22 June	1·26	..	..	..	..	..	..	..	..	..	..	.	..	1 Oct.	1·26		16 Oct.
191	22 June	1·26	..	..	..	..	..	..	..	..	..	..	..	..	14 Nov.	1·26	..	23 Nov.
192	22 July	·81	..	..	..	..	..	..	1 Aug.	·81	·98	12 Oct.	·98	1·14	14 Nov.	1·14	..	29 Nov.
198	15 Aug.	·51	28 Aug.	·51	·68	15 Oct.	·68	·84	28 Nov	·84	(Pupa)						..	12 Dec.
199	15 Aug.	·67	.	..	.	15 Sept.	·67	·86	11 Oct.	·86	1·00	20 Nov.	1·00	1·19	12 Dec.	1·19	..	..

* (±) 2 days; in many instances the date is exact.

† Ecdysis recorded on 9 June, (A–B) measurement of exuvium being ·39 and that of larva ·51

adults. Each larva was watched carefully, and the necessary measurements of both larva and exuvium were taken after all the later ecdyses (Table IV.). It now seems apparent that at least the last five larval instars of *L. variabilis* can be recognised by referring the measurements of the greatest widths of their ventral mouth parts to Table II. During this year (1932) larvæ in different stages were taken from the fields at intervals and reared to adults (Table V.). This was done mainly for two purposes—firstly, to obtain additional evidence along the lines utilised in Table IV.; and secondly, to compare the development of the larvæ reared in the laboratory, from eggs to adults, with those living under field conditions during various portions of their existence.

Between December, 1932, and November, 1933, with a better knowledge of the environmental conditions desired by the smaller instars, and with more suitable rearing apparatus, 107 larvæ were taken through from eggs to adults. In 49 instances a complete set of eight larval exuviæ for each specimen under observation was obtained and the larval and exuvial (A-B) measurements were recorded as in Table VIA. In other instances an occasional exuvium was missed out; however (A-B) measurements taken of all exuviæ found, and also of the related larvæ, were in accord with what would be expected after a study of the recorded observations of which a portion are set out in Table VIA. There now seems to be no doubt that there are normally eight instars in the larval life of *L. variabilis*, and that any larval specimen of this species can be given its correct "instar number" by referring the measurement, in millimetres, of the greatest width of its ventral mouth parts to the eight distinct groups of Tables II. and III.

As in previous years a small proportion of the larvæ behaved in a manner similar to No. L2.3. of Table IV., i.e., pupation was reached after less than eight larval moults, and in four instances a complete set of six larval exuviæ for each specimen was recovered. In each instance the (A-B) measurement of the final larval exuvium corresponded to that of a larva in its sixth instar. When there are only six instars during the life of a larva, any resulting adult is invariably a small male. As in 1932 observations were made on numerous specimens collected in the field; records of such are very similar to those recorded in Table V.

In compiling the tables for this article from records of observations on larvæ reared from eggs in the laboratory, no references have been made to those instances when only one or two ecdyses (with necessary measurements) were recorded of any larvæ which, for some reason or other, were not taken through to pupation. The inclusion of such records would easily double the "ecdysal" measurements similar to those of Tables IV.-VIA., and it would be merely added evidence in favour of the points which these tables already demonstrate.

Antennal Segment Ratios and Other Mouth Part Measurements.

Roberts (16), when describing the first larval instar of an *Agriotes* sp., points out that the third, or supplementary segment in an antenna is longer than the conical ventral process at the apex of the second, but that this difference is much less in the mature larvæ. At this stage it is also much longer in proportion to the whole antenna than in the older larvæ. When working with *L. variabilis* it was found to be very difficult to measure accurately the true lengths of the segments of the antennæ (see Plate 1, fig. D.). Each segment can be withdrawn,

TABLE VIA.

(A–B) MEASUREMENTS IN MILLIMETRES AS DETERMINED FROM THE RECORDED OBSERVATIONS ON 49 LARVÆ.

Laboratory No. of Larva.	Egg Laid.	First Instar. Date of Emergence.	First Instar. (A–B) Measurement.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.
4	20 Nov., 32	28 Nov., 32	·162	5 Dec., 32	·162	·233	19 Dec., 32	·23	·39	12 Jan., 33	·39	·52	11 Feb., 33	·52	·65
5	20 Nov., 32	28 Nov., 32	·162	6 Dec., 32	·162	·237	18 Dec., 32	·24	·38	15 Jan., 33	·38	·52	24 Jan., 33	·52	·66
12	5 Dec., 32	12 Dec., 32	·161	24 Dec., 32	·161	·233	13 Jan., 33	·234	·40	16 Feb., 33	·40	·54	3 Mar., 33	·54	·70
26	21 Nov., 32	28 Nov., 32	·167	4 Dec., 32	·167	·235	11 Dec., 32	·24	·39	19 Dec., 32	·39	·53	1 Jan., 33	·53	·65
30	8 Dec., 32	15 Dec., 32	·165	24 Dec., 32	·165	·233	3 Jan., 33	·23	·38	20 Jan., 33	·38	·52	3 Feb., 33	·52	·67
33	5 Dec., 32	13 Dec., 32	·163	24 Dec., 32	·163	·234	13 Jan., 33	·234	·36	4 Feb., 33	·36	·52	20 Feb., 33	·52	·68
35	5 Dec., 32	12 Dec., 32	·163	19 Dec., 32	·163	·236	26 Dec., 32	·236	·38	10 Jan., 33	·38	·52	15 Feb., 33	·52	·63
37	13 Dec., 32	21 Dec., 32	·163	3 Jan., 33	·163	·233	24 Jan., 33	·233	·37	4 Feb., 33	·37	·53	21 Feb., 33	·53	·68
39	3 Jan., 33	10 Jan., 33	·163	24 Jan., 33	·163	·234	4 Feb., 33	·235	·37	21 Feb., 33	·37	·51	23 Mar., 33	·51	·66
41	3 Dec., 32	12 Dec., 32	·163	19 Dec., 32	·163	·233	25 Jan., 33	·233	·39	14 Feb., 33	·39	·53	16 Mar., 33	·53	·67
62	5 Jan., 33	12 Jan., 33	·162	24 Jan., 33	·162	·235	13 Feb., 33	·235	·38	24 Feb., 33	·38	·53	9 Mar., 33	·53	·67

TABLE VIA.—*continued.*

(A–B) MEASUREMENTS IN MILLIMETRES AS DETERMINED FROM THE RECORDED OBSERVATIONS ON 49 LARVÆ—*continued.*

Laboratory No. of Larva.	Egg Laid.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	(A–B) Measurement of Larva.	Date.	(A–B) Measurement of Exuvium.	Pupa.	Date of Appearance of Adult.	Length of Complete Larval Period (in days).
4	20 Nov., 32	15 Mar. ..	·65	·82	7 May ..	·82	·98	27 May ..	·98	1·15	7 Nov. ..	1·15	..	21 Nov., 33	344
5	20 Nov., 32	18 Feb. ..	·66	·85	10 Apr. ..	·85	1·00	30 May ..	1·00	1·20	1 Nov. ..	1·20	..	15 Nov., 33	338
12	5 Dec., 32	3 Apr. ..	·69	·86	7 May ..	·86	1·00	15 June ..	1·00	1·16	10 Nov. ..	1·16	..	24 Nov., 33	333
26	21 Nov., 32	23 Jan. ..	·69	·84	4 Feb. ..	·84	·98	20 Mar. ..	·98	1·12	26 Apr. ..	1·12	..	11 May, 33	149
30	8 Dec., 32	1 Mar. ..	·67	·82	29 Mar. ..	·82	·98	11 May ..	·98	1·15	26 Oct. ..	1·15	..	7 Nov., 33	315
33	5 Dec., 32	16 Mar. ..	·68	·85	5 Apr. ..	·85	1·00	13 May ..	1·00	1·20	9 Nov. ..	1·20	..	23 Nov., 33	331
35	5 Dec., 32	12 Mar. ..	·69	·85	1 Apr. ..	·85	1·00	9 June ..	1·00	1·16	14 Nov. ..	1·16	..	28 Nov., 33	337
37	13 Dec., 32	23 Mar. ..	·68	·82	1 May ..	·82	·98	9 June ..	·98	1·16	14 Oct. ..	1·16	..	29 Oct., 33	297
39	3 Jan., 33	1 May ..	·66	·81	9 June ..	·81	·98	4 July ..	·98	1·12	4 Nov. ..	1·12	..	19 Nov., 33	298
41	3 Dec., 32	19 Apr. ..	·67	·84	10 May ..	·84	1·00	21 June ..	1·00	1·21	10 Nov. ..	1·21	..	24 Nov., 33	333
62	5 Jan., 33	25 Mar. ..	·67	·82	29 Apr. ..	·82	1·00	30 May ..	1·00	1·21	15 Nov. ..	1·21	..	30 Nov., 33	307

TABLE VIB.

Laboratory No. of Larva.	(A–B) MEASUREMENTS OF INSTARS (IN MM.).														
	1st	A	2nd	B	3rd	C	4th	D	5th	E	6th	F	7th	G	8th
4	·162	·071	·233	·157	·39	·13	·52	·13	·65	·17	·82	·16	·98	·17	1·15
5	·162	·075	·237	·143	·38	·14	·52	·14	·66	·19	·85	·15	1·00	·20	1·20
12	·161	·072	·233	·167	·40	·14	·54	·16	·70	·16	·86	·14	1·00	·16	1·16
26	·167	·068	·235	·155	·39	·14	·53	·16	·69	·15	·84	·14	·98	·14	1·12
30	·165	·068	·233	·147	·38	·14	·52	·15	·67	·15	·82	·16	·98	·17	1·15
33	·163	·071	·234	·126	·36	·16	·52	·16	·68	·17	·85	·15	1·00	·20	1·20
35	·163	·073	·236	·144	·38	·14	·52	·17	·69	·16	·85	·15	1·00	·16	1·16
37	·163	·070	·233	·137	·37	·16	·53	·15	·68	·14	·82	·16	·98	·18	1·16
39	·163	·071	·234	·136	·37	·14	·51	·15	·66	·15	·81	·17	·98	·14	1·12
41	·163	·070	·233	·157	·39	·14	·53	·14	·67	·17	·84	·16	1·00	·21	1·21
62	·162	·073	·235	·145	·38	·15	·53	·14	·67	·15	·82	·18	1·00	·21	1·21
L1. 1	..	..	..	..	..	..	..	..	..	..	·79	·19	·98	·16	1·14
L1. 3	..	..	..	..	..	..	·54	·13	·67	·17	·84	·19	1·03	·21	1·24
L 22. 11 ..	..	..	..	..	..	..	·51	·12	·63	·16	·79	·19	·98	·17	1·15
L2. A1 ..	..	..	·26	·13	·39	·12	·51	·14	·65	·16	·81	·17	·98	·14	1·12
L22. 26 ..	..	..	..	..	..	..	..	..	·65	·17	·82	·21	1·03	·14	1·17
L7. A8 ..	..	..	..	..	..	..	..	..	..	..	·82	·16	·98	·16	1·14
132	..	..	..	..	..	..	..	..	·65	·11	·86	·17	1·03	·18	1·21
146	..	..	..	..	..	..	·51	·19	·70	·16	·86	·12	·98	·18	1·16
158	..	..	..	..	..	..	·47	·20	·67	·15	·82	·16	·98	·17	1·15
169	..	..	..	..	..	..	..	..	·65	·17	·82	·18	1·00	·16	1·16
182	..	..	..	..	·39	·12	·51	·16	·65	·17	·82	·16	·98	·17	1·15
192	..	..	..	..	..	..	..	..	..	..	·81	·17	·98	·16	1·14
198	..	..	..	..	..	..	·51	·17	·68	·16	·84	..	..	..	..
199	..	..	..	..	..	..	..	..	·67	·19	·86	·14	1·00	·19	1·19

Columns headed by ordinates give (A–B) measurements of instars, whilst columns headed by the letters A, B, C, &c., give differences in (A–B) measurements of larvæ in successive instars. All measurements in millimetres.

wholly or partly, into the one preceding it and the whole antenna may be withdrawn into the head capsule. The same difficulty is encountered when attempting to measure some of the mouth parts and their appendages. The maxillary palps may telescope wholly or partly and the dististipites (Plate 1, fig. A., *dis.*) and appendages connected with them may be withdrawn into the stipites; the mentum may house the prementum. It is considered that the use of antennal segment ratios for distinguishing the different instars is attended by too many difficulties. Table VII. gives the ratios, obtained after many measurements, of the lengths of the antennal segments for all larval instars; all measurements having been brought to a common denominator.

Measurements were made of the distance from the tips of the mandible to the condyles, but quite often when the larger instars are nearing the completion of stadia, the tips of the mandibles become worn, as also do the processes of the nasale.

TABLE VII.—ANTENNAL SEGMENT RATIOS. IN THE COLUMN DEALING WITH THE SECOND SEGMENTS THE UPPER FIGURES REPRESENT THE LENGTHS OF THE SEGMENTS WHILE THE LOWER FIGURES RELATE TO THE CONICAL PROCESSES AT THE APICES OF THE SEGMENTS.

Instar.	Segments of Antenna.		
	First.	Second.	Third.
First	6	9 10	14
Second	16	15 12	16
Third	26	20 15	20
Fourth	40	28 18	24
Fifth	54	38 19	27
Sixth	70	46 20	30
Seventh	90	58 21	34
Eighth	110	68 22	40

DESCRIPTION OF PLATE 1.

Lacon variabilis Cand.

A.* Ventral mouth parts. Dis., dististipites; st., stipites; m., mentum; c., cardo × 24.

B. Ventral view of head showing ventral mouth parts *in situ* × 24.

C. Dorsal view of full-grown larva × 3.

D.* Antenna of sixth larval instar × 60.

E.* Transverse section through head region showing mentum fused with the stipites of the maxillæ. M., mentum; st., stipites; ma., mandible; a., antenna × 60.

* Drawn from permanent mounts.

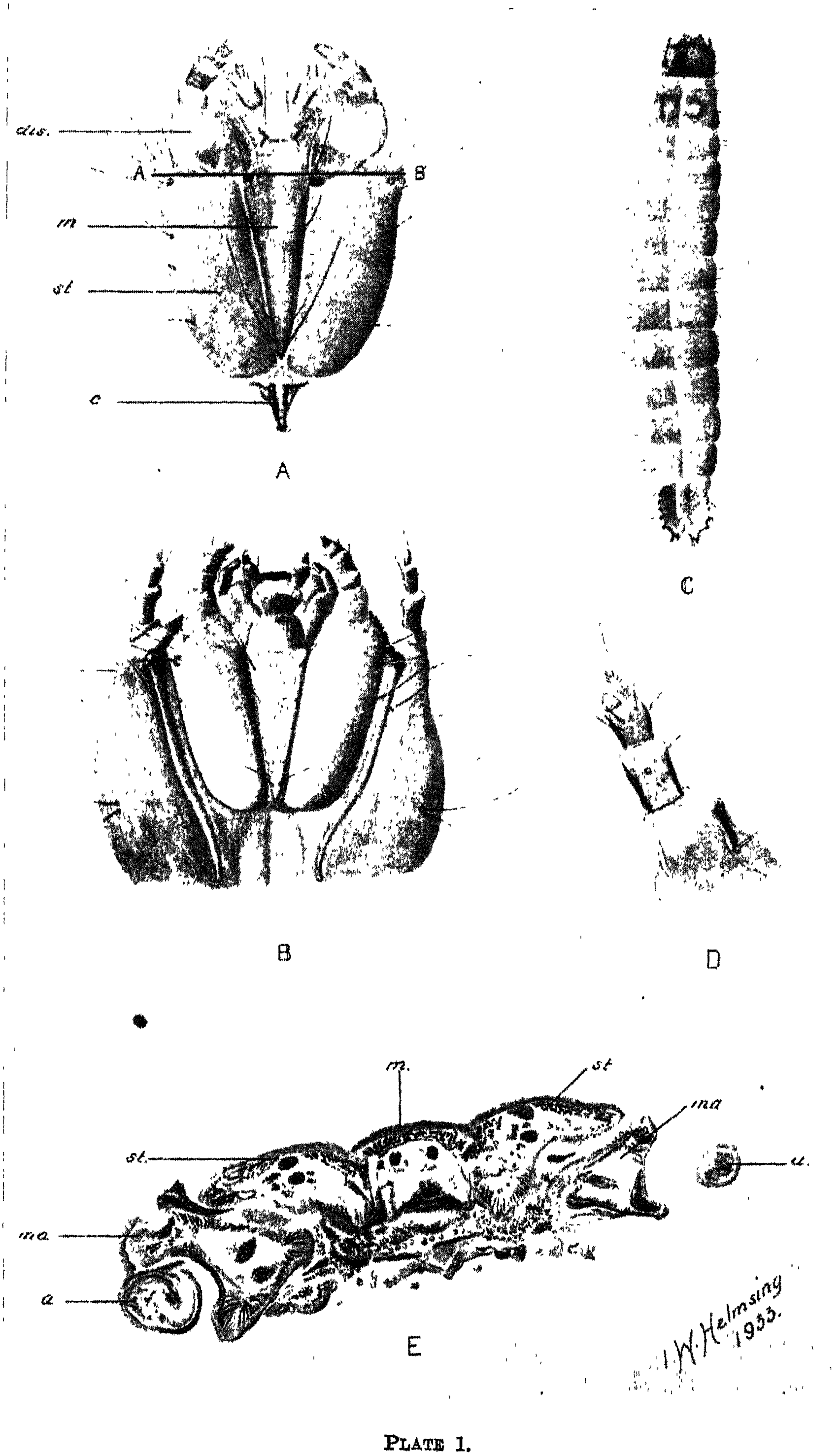

PLATE 1.

Width of the Head Capsule.

In all probability this measurement could have been utilised in determining the instars of *L. variabilis* had no other criterion been of outstanding value. Measurements of the widths of the head capsules are not as accurate as those of the ventral mouth parts, as the capsules may be ruptured during ecdyses. Furthermore, the comparatively compact nature of the ventral mouth parts (see Plate 1, figs. B. and E.) does not allow of their losing shape when being measured in exuviæ, whereas the empty moulted head capsules tend to flatten, with consequent increase of width. When dealing with living specimens, the accurate measurement of the ventral mouth parts is much more easily carried out than that of the head capsules. Measurements of the head capsules of each instar are such that, where v = greatest width of the ventral mouth parts, and h = width of head capsule, $v = kh$, k being a constant which closely approximates to ·60 for any specimen of any larval instar of *L. variabilis*.

Time of Feeding of an Instar.

During 1931, when length measurements only were determined, it was apparent that feeding was not continuous (see Table I.). Later it was observed that, in the continued presence of vegetable material and suitable soil moisture, a *L. variabilis* instar feeds voraciously for a short period immediately after an ecdysis and does not feed again during that stadium. As examples Nos. 4, 5, 30, and 33 of Table VIA. may be cited. Nos. 30 and 33 were in the final larval instar by the middle of May, Nos. 4 and 5 by the end of May; Nos. 30 and 33 pupated in late October and early November respectively, but both had finished feeding by the first week in June while Nos. 4 and 5 had finished feeding by the third week in June. At all times, from May to November, vegetable material and suitable soil moisture conditions were present in the jars containing the larvæ in order to encourage the feeding of this particular instar. If either of the two environmental factors governing feeding is unfavourable immediately after an ecdysis the larva will ingest soil, but if suitable conditions are provided at a later stage during the stadium, the one large feed of vegetable material will be taken. In addition to the effect on the time of feeding, variations in these environmental conditions have an effect on the measurable length of an instar.

Appearance of an Instar Prior to Ecdysis.

Prior to ecdyses all instars become torpid, their general shape and colouring changes, and in many instances the measurable length is increased. The body segments may assume the appearance of a short string of tightly-strung broad-ended beads, with indentations here and there in the lateral and ventral regions. The general colour is paler than that of the normal active larvæ. In this pre-ecdysal state a larva may exist for periods ranging from two days (smaller instars), to as long as two months (last larval instar). This distinctive appearance of the instars before ecdyses, and their heavy feeding immediately after ecdyses, when conditions are at all suitable, were of considerable help during the rearing work of 1932-33 in enabling us to place within a few days the dates of some of the ecdyses of the smaller and moderately-sized instars.

A Peculiarity in Shape of the First Larval Instar.

It was found that the larvæ of *L. variabilis* do not assume the specific shape of the ninth abdominal segment until the second instar

(see Plate 2, figs. C, D, and E), and as a result the first instar can be separated from all other larval instars on the basis of the shape of the ninth abdominal segment alone.

Discussion.

Concerning the use of head width measurements Imms (7) states:—"Dyar has shown from observations on the larval instars of twenty-eight species of Lepidoptera that the head-width follows a regular geometric progression in successive instars. Since the head is not subject to growth during a stadium it is possible, by means of accurate measurements, to determine whether ecdysis has been overlooked during life-history studies." During the past few years some workers ([a]) have attempted to apply Dyar's Law to other orders of insects, not only as a means of determining whether an ecdysis has been overlooked or not during life-history studies, but also in some instances for the purpose of estimating the number of instars in some particular species. The procedure usually adopted is to measure accurately the widths of the head capsules of a sufficiently large random population and then arrange the measurements in an ascending order of magnitude. Measurements are next divided into well-defined groups, if possible, and the mean of each group calculated. The possibility of these means advancing in geometrical progression is then investigated and as much rearing work as possible is carried out.

This procedure has been followed in dealing with *L. variabilis* with this exception, that for greater convenience and accuracy, the greatest widths of the ventral mouth parts (v) were measured instead of the widths of the head capsules (h) ($v = 0{\cdot}60 \times h$, see page 56). In Table VIII. are set out eight groups, together with means, &c., and it is demonstrated by the measurements taken during the rearing of larvæ from eggs to adults, that each group represents an instar. In compiling this table all data as shown in Tables II. and III. are used in conjunction

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(*a*) Metcalfe (12) found that the head measurements of 887 specimens of a random population of *Sitodrepa panicea* L. fell into two sets of groups, the growth ratios of which approximated to two geometric series; it is suggested that these two sets represent sexes. No satisfactory conclusions with regard to the number of early instars could be reached owing to the inadequate number of larvæ obtained.

Miles (13) found that in the Tenthredinidæ studied by him growth and development appear to be more complicated than in the larvæ of Lepidoptera first reported by Dyar. Sex differentiation is considered to render the larval growth of the later instars irregular.

Prebble (14) found that the larval growth rate of three bark-beetles conformed satisfactorily with Dyar's Law. One species has four larval instars and the other two species three.

Andrewartha (1) measured the head widths of 147 larvæ of *Otiorrhynous cribricollis* Gyll. It was considered that the grouping of these measurements, together with some relevant circumstantial evidence, demonstrated that there are ten instars in the larval life of *O. cribricollis*. For this species Dyar's Law was found to hold good when applied to the average head width of an instar. From this work Andrewartha concludes that "we now have a reliable method for determining the number of instars in the life of soil-inhabiting, leaf-mining, and other inaccessible larvæ." The actual application of the method together with direct evidence shows that, so far as *L. variabilis* and several other species of Elateridæ are concerned, the above conclusion is not altogether correct. The application of Dyar's Law, in its entirety, to the average head width of successive instars seems to have some limitations.

with similar measurements of the larvæ represented in Tables IV., V., and VIA. From Table VIII. it will be seen that the means of the groups representing the last seven larval instars are very approximately in regular arithmetical progression with a common difference of ·15 to ·16 (theoretically ·153).

TABLE VIII.

Groups Representing the Larval Instars.	Observed. A-B Measurements in mm. Minimum.	Mean.	Maximum.	Common Difference.	Calculated.* Mean.	Common Difference.
1	·161	·163	·167		..	
				·067		..
2	·21	·23	·28		·23	
				·15		·153
3	·35	·38	·40		·383	
				·15		·153
4	·47	·53	·55		·537	
				·15		·153
5	·63	·68	·70		·690	
				·16		·153
6	·79	·84	·86		·843	
				·15		·153
7	·96	·99	1·03		·997	
				·16		·153
8	1·12	1·15	1·26		1·15	

* ·23 has been taken as the first term and 1·15 as the last.

Table VIB. indicates that the (A-B) measurements of the last seven larval instars of a single larva are also approximately in regular arithmetical progression; for this table the same examples of larval records as given in Table VIA. are used, together with some from Tables IV. and V. The first larval instar is well separated from all other instars, both on the shape of its ninth abdominal segment and on the isolation of its (A-B) measurement when those of all instars are placed in a regular series.

Other Species of Elateridæ.

By the method of grouping the (A-B) measurements of a random larval population, and then using the information as a guide in rearing

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DESCRIPTION OF PLATE 2.

Lacon assus Cand.

A.* First larval instar; dorsal view of ninth abdominal segment × 60.
B. Full-grown larva; dorsal view of ninth abdominal segment × 12.

Lacon variabilis Cand.

C.* First larval instar; dorsal view of ninth abdominal segment × 60.
D.* Second larval instar; dorsal view of ninth abdominal segment × 60.
E. Full-grown larva; dorsal view of ninth abdominal segment × 15.

* Drawn from permanent mounts.

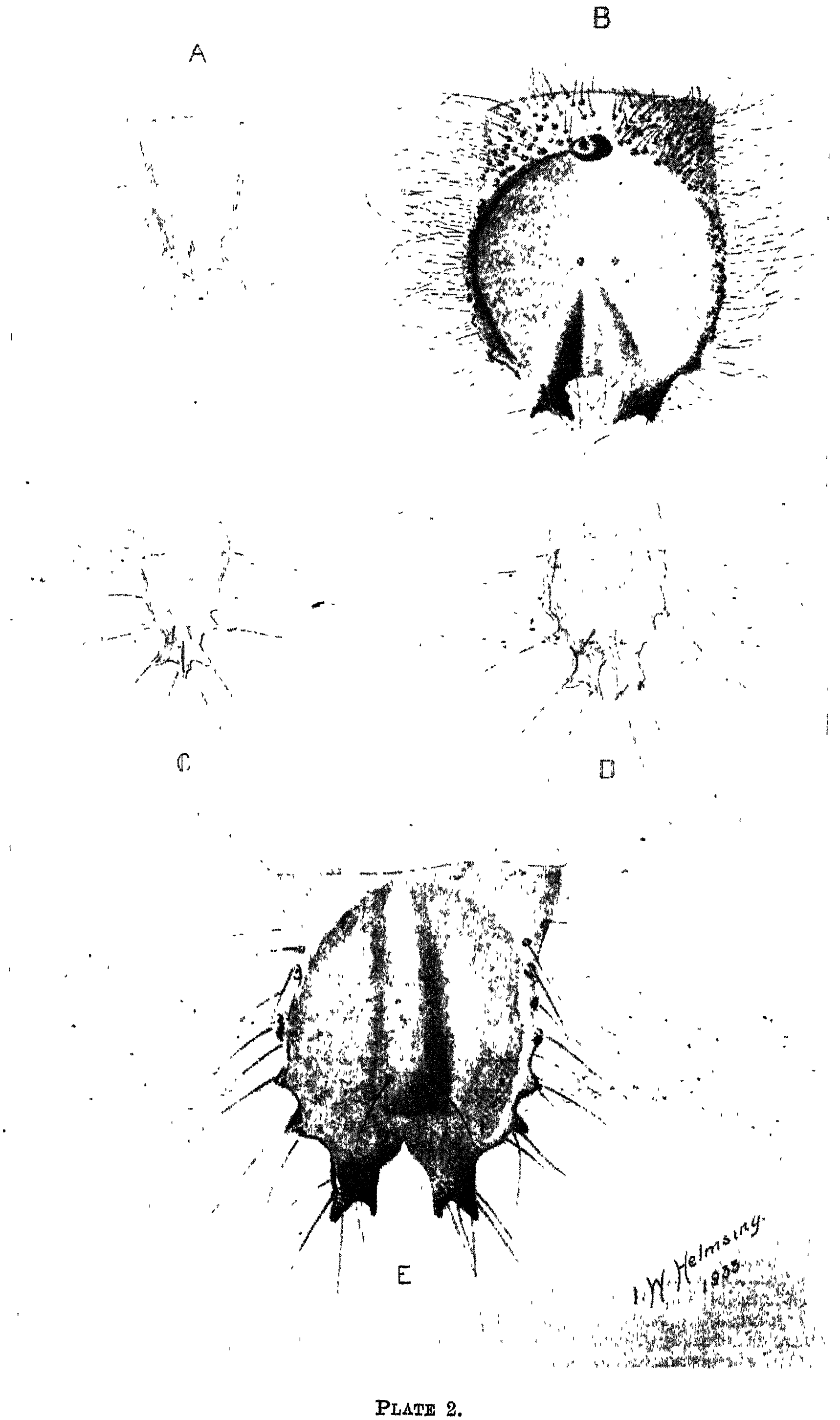

PLATE 2.

work, it was found that with *Heteroderes carinatus* Blbn. ([a]), *Heteroderes cairnsensis* Blbn., five other *Heteroderes* species, *Lacon humilis* Er., *Lacon lateralis* Schw., and seven other *Lacon* species, each group represents an instar. Further, the means of the groups (with the exception of those representing the first larval instars) for each species advance approximately in arithmetical progression. As with *L. variabilis*, so with all the above-mentioned species, the specific shapes of the ninth abdominal segments are not assumed until the second larval instars. The ninth abdominal segments of *L. lateralis, H. carinatus*, and *H. cairnsensis* are illustrated in Plate 3 (figs. A to F), while *L. assus* Cand. is similarly treated in Plate 2 (figs. A and B). This species has been reared from the egg up to the third larval instar and over the last two larval instars, and there is every indication that the larval growth of *L. assus,* as expressed by the increase of the (A-B) measurements of successive instars, is similar to that of the other *Lacon* species with which more complete rearing work has been carried out.

Hyslop (2) in his drawings of the first and last larval instars of *Monocrepidius lividus* illustrates and draws attention to a difference in shape of the ninth abdominal segments which is similar to that found in many of the species mentioned in this article.

Some observations have been made on two species of larvæ (of the yellowish semi-flattened type) the adults of which have not been even generically identified. One here termed B sp.[a] and the other Y sp. (commonly found when chipping in some of the hillside country around Mackay) behave, in so far as growth of the last five larval instars are concerned, in a manner similar to the *Lacon* species, and *Heteroderes* species. The smaller instars of B sp. and Y sp. have not been studied.

No species with the cylindrical type of larva have been studied in detail. The (A-B) measurements of twenty-four cylindrical larvæ of the same species taken from rotted wood could be placed into four distinct groups; the means of these groups approximated very closely to an arithmetic progression. Exuvial measurements taken as the larvæ were reared to adults (four obtained) indicate that each group represents an instar.

Times of feeding of all the *Lacon* species, all the *Heteroderes* species and B sp. are similar to that of *L. variabilis* as described on page 56.

C. LARVAL STADIA.

Lacon variabilis.

As climatic conditions play a great part, both in the variation of the larval stadia of *L. variabilis* and in the incidence of this pest in

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(*a*) The writer is indebted to the British Museum for the identification of *H. carinatus, H. cairnsensis, L. variabilis, L. assus, L. lateralis,* and *L. humilis. H. carinatus* is listed as *Monocrepidius* in Master's Catalogue (1886) (according to a communication from H. Hacker, Queensland Museum), and specimens of *H. cairnsensis* are labelled *Monocrepidius cairnsensis* in the Bureau collection at Meringa. In *Coleoptera of North America* (1883) Leconte and Horn state: "The genus *Heteroderes,* adopted by Candeze, appears to be untenable and heterogeneous; our species are therefore referred to *Monocrepidius.*"

[a] The British Museum authorities identify this species as Gen. (?) (near Athous).

different years (10), fig. 1 has been inserted for the purpose of giving some idea of the climatic conditions prevailing in the Mackay district. Although there are large variations in rainfall in different years, the usual climatic sequence is a wet season of varying intensity between December and March, moderate winter rains, and a comparatively dry spring followed by thunderstorms in early November.

Many field observations made during 1932-33 indicated that, in general, the behaviour of the larvæ of *L. variabilis* in the rearing jars in the laboratory during those years, very closely resembled that of the larvæ under natural field conditions. For the purpose of discussing the stadia of larvæ under natural conditions, the larvæ may be divided into three classes according to the period of the year during which pupation takes place, together with the period of oviposition of the eggs, from which the larvæ emerge. These three classes are—(*a*) Those which emerge from eggs deposited durnig the period November-February and which pupate in the following October to January; (*b*) Those which emerge from eggs deposited in November-January and which pupate in the following March to April; (*c*) Those which emerge from eggs laid by adults from "*b*" class larvæ and which pupate in the following November to January.

Tables IX. and X. present a record of the larval stadia of forty-eight "*a*" class larvæ reared during 1933. It is considered that these tables illustrate the normal growth rate of the larvæ under the usual climatic conditions of the Mackay district (see fig. 1). The true average length

TABLE IX.—STADIA OF LARVAL INSTARS DETERMINED FROM THE RECORDED OBSERVATIONS ON 53 LARVÆ, 48 BEING "a" CLASS AND 5 "b" CLASS.

Laboratory Number of Larva.	Stadia (in Days) of the Larval Instars.								Complete Larval Period.
	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	8th.	
4	7	14	24	30	32	53	20	164	344
5	8	12	28	9	25	51	50	155	338
12	12	20	34	15	31	34	39	148	333
26	6	7	8	13	22	12	44	37	149
30	9	10	17	14	26	28	43	168	315
33	11	20	22	16	24	20	38	180	331
35	7	7	15	36	25	20	69	158	337
37	13	21	11	17	30	39	39	127	297
39	14	11	17	30	39	39	25	123	298
41	7	37	20	30	34	21	42	142	333
62	12	20	11	13	16	35	31	169	307

TABLE X.—LARVAL STADIA DETERMINED FROM THE RECORDED OBSERVATIONS ON 48 "*a*" CLASS LARVÆ REARED FROM EGGS TO ADULTS DURING 1933.

Larval Instar.	Stadia (in Days).			
	Minimum	Mean.	Maximum.	Standard Deviation.
1st	5	9·5	14	2·73
2nd . ..	7	14·9	37	6·16
3rd	11	18·9	34	4·82
4th	13	20·2	31	8·48
5th	16	28·2	39	7·16
6th	20	32·8	53	9·78
7th	20	38·2	69	12·11
8th	119	152·0	180	16·67

of the larval period of these forty-eight specimens was 314·8 days. During 1933 a total of 102 "*a*" class larvæ reared from eggs to pupæ spent an average of 302·2 days in the larval state. The forty-eight larvæ of Table X. are included in this number, some of which hatched from eggs deposited fairly late during the November-February period. During 1932, 128 "*a*" class larvæ spent a true average of 279·4 days in the larval state but, as Tables IV. and VIA. indicate, in 1932 a greater proportion of the observed larvæ were hatched from eggs deposited in January or early February than was the case in 1933, when many of the eggs used for rearing purposes were obtained in November and December.

In 1932, six out of 134 larvæ reared from eggs oviposited during November-January pupated during the following March and April, while in 1933, five out of 107 behaved similarly. During the two years, the minimum larval periods of these "*b*" class larvæ were fifty-seven days for those passing through six larval stadia only before pupation, and sixty-eight days for those with eight larval instars. Another "six larval instar" specimen required 161 days to complete its larval life. When the stadia of these "*b*" class larvæ are compared with those of

DESCRIPTION OF PLATE 3.

Lacon lateralis Schwarz.

A. Full-rown larva; dorsal view of ninth abdominal segment × 15.
B.* First larval instar; dorsal view of ninth abdominal segment × 60.

Heteroderes carinatus Blbn.

C. Full-grown larva; dorsal view of ninth abdominal segment × 15.
D.* First larval instar; dorso-lateral view of ninth abdominal segment × 60.

Heteroderes cairnsensis Blbn.

E. Full-grown larva; dorsal view of ninth abdominal segment × 15.
F.* First larval instar; dorso-lateral view of ninth abdominal segment × 60.

* Drawn from permanent mounts.

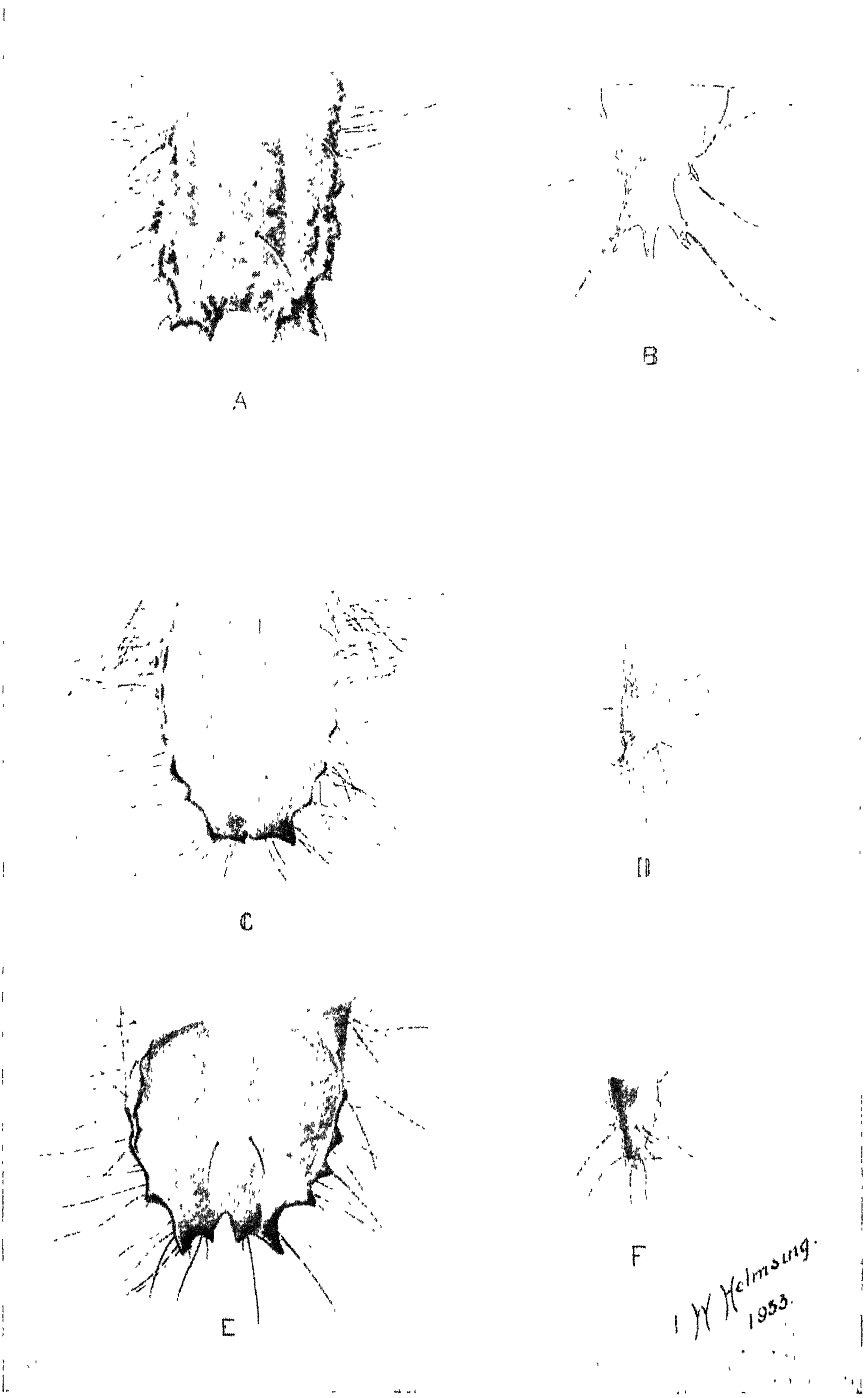

PLATE 3.

"a" class, as in Tables IX. and X., a shortening of some of the stadia is evident. Of course the last two stadia exhibit the greatest actual reductions, but not always the greatest proportional reductions.

The "c" class larvæ are considered to be even more rare in the field than are the "b" class larvæ. This is to be expected (see Section D and fig. 1) as the normal climatic conditions militate against the survival of the smaller instars. In the laboratory many of the adults from

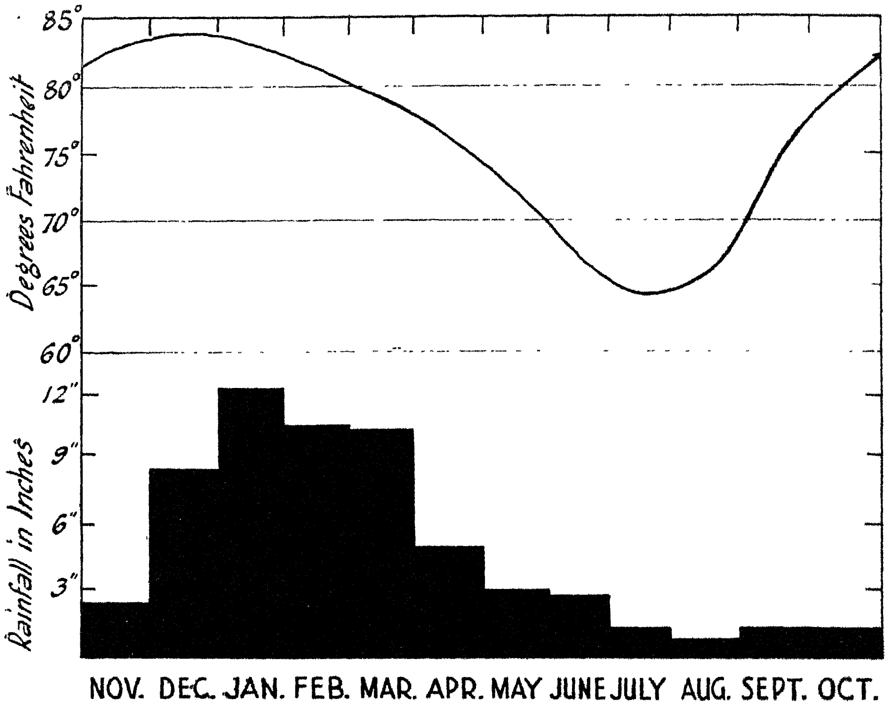

PLATE 4.

Mean monthly rainfall, in inches, and mean 9 a.m. shade temperatures at the Mackay Sugar Experiment Station for the twenty years 1910-1930, both inclusive, but with 1918—an abnormal cyclone year—excluded.

"b" class larvæ do not oviposit except under such an artificial condition as increased temperature. It is an easy matter to take the larvæ which emerge from eggs so obtained over the first four or five larval instars, provided the temperature is kept up and suitable soil moisture is provided; under normal environmental conditions the mortality percentage is very high, although once a larva reaches its fourth or fifth larval stadium it will survive under normal conditions. Comparing the stadia of "c" class larvæ with those represented in Tables IX. and X. it will be found that generally speaking the earlier stadia are considerably lengthened at the expense of a very noticeable shortening of the later ones.

It is impossible to state definitely whether a small larva found in the field in August or September is in the "a" or "c" classes as it may be an "a" class larva from an egg deposited in late January or February,

which during its early larval life experienced unfavourable environmental conditions. As "*c*" class larvæ are considered to be so rare, it is usual to place any small larvæ found in the field during August and September into the "*a*" class, but this classification may be proven to be incorrect if the larvæ are reared to pupation. As in the "*b*" class so some "*c*" class larvæ pupate at the end of the sixth larval instar, but this has never been found to occur when dealing with any larvæ known to belong to the "*a*" class. If "*a*" class larvæ are kept over the winter in soil with suitable moisture and at the mean shade temperature for October (79·7 deg. F., see fig. 1) they pupate as early as June and never later than August; there are always eight larval stadia.

On the 27th July, 1933, thirty larvæ in their eighth instars were taken from the field. Fifteen were placed in a chamber kept at approximately the mean shade temperature for October, and all had pupated by the 20th August. The second fifteen were reared under normal conditions (i.e., similar to the conditions experienced by the other fifteen except for the increased temperature), and these pupated in late October and November.

Adults of *L. variabilis* have, collectively and sometimes singly, a rather lengthy laying period—collectively from October to February for the majority, and from March to April, for a very few. The vast majority of adults appear in November and early December; the pupal stage is approximately fourteen days and the adults do not remain long in the pupal cells. The first oviposition usually takes place at about three to four weeks after the emergence of the female adult. Irrespective of the exact time of oviposition within the November-February period, and the environmental conditions subsequently encountered by the larvæ, pupation takes place either in the following May-April or October-January. There is no "hang-over," and even all "*c*" class larvæ pupate not later than the January following the May-April during which they had emerged from eggs.

In addition to environmental conditions, some physiological difference in their make-up may be responsible for the fact that some larvæ pupate at the end of their sixth larval stadia and some pupate before the winter, after passing through eight larval stadia.

Other Species of Wireworms.

Under Mackay conditions the following species normally have egg, pupal, and larval periods of very similar length to those of *L. variabilis*, viz.—*Heteroderes carinatus*, *H. cairnsensis*, five other *Heteroderes* species, *Lacon humilis*, *L. lateralis*, seven other *Lacon* species and B. sp. These species also pass through larval stadia in a manner similar to *L. variabilis*, i.e., the earlier stadia are short compared to the last one or two, especially the final one. Many specimens of all these species are to be found in the fields or in grass lands in either of their last two larval stadia by July-August, although they do not pupate until September-February. The majority of adults of *L. variabilis* are to be found in suitable places in the field in November and early December. However, this is not so for some of the other species; B sp. is found in the adult stage in largest numbers as early as the middle of October. Adults of *H. cairnsensis* are often found in large numbers with any early appearing *L. variabilis* adults. Adults of *H. carinatus*, the other *Heteroderes* species, *L. humilis*, *L. lateralis*, and other *Lacon* species are

to be found in greatest numbers during the wet season (January and or February). *L. lateralis* is usually the species of Elaterid adult most common during the latter end of the wet season; *L. assus* also appears in greatest numbers during the wet season. The earlier larval stadia of this species are also short as compared to the final one. Specimens of two of the unidentified *Lacon* species have pupated leaving exuviae with (A-B) measurements corresponding to those of larvae which have not reached their second last larval instars.

D. TECHNIQUE.

Obtaining and Hatching the Eggs.

From most species eggs were obtained by placing female adults in glass jars (see below) which were two-thirds filled with soil of moisture of about one-half that of the "sticky point" (a). Potato tuber was sometimes supplied as *Lacon variabilis* adults and those of some of the other species gnaw it. Eggs were hatched either in the soil in the jars in which the females had been confined, or singly in soil in the receptacles to be used for rearing the larvae during the smaller instars.

In the matter of distinguishing the female adults from males, size is often of considerable help; for all species with which the writer dealt the smaller specimens were invariably males and the larger ones were females. Adults of *L. variabilis* were examined in more detail than those of other species, and in this species the very small adults are males, the large ones are females, and those of medium size may be either male or female. External sex differences are more definite in the pupal than in any other stage; they are manifest on the venters of the

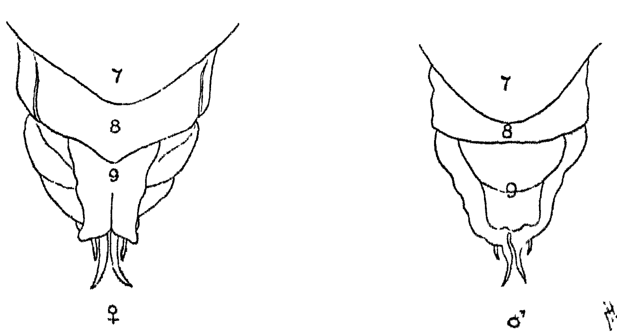

PLATE 5.

Ventral views of eighth and ninth abdominal segments of *Lacon variabilis* pupae: ♀ and ♂ × 15.

ninth abdominal segments. The sex difference in *L. variabilis* pupae as illustrated in fig. 2 is similar to that for all *Heterodcres* species and *Lacon* species examined by the writer.

(a) E. S. West defines the "sticky point" as the moisture content of the soil expressed as per cent. oven-dried soil, when the kneaded soil mass just fails to adhere to external objects. (Observations on Soil Moisture and Water Tables in an irrigated soil at Griffith, New South Wales, 1933.)

When any of the soils used in all of the wireworm work was considered to be in a state of good tilth, it was found that the moisture content was at about one half the "sticky point."

Rearing the Larvæ.

Four-ounce glass jars with metal screw caps were used as cages in general rearing work with most of the species, but for some of the species with larger larvæ (e.g., *Agrypnus mastersi* Macl.) larger jars of the same type were found to be necessary. Each larva was kept separately in a jar two-thirds filled with soil on which was placed, cut surface downwards, a piece of potato tuber; for larvæ known to be carnivorous, scarabæid larvæ were supplied instead of potato tuber. When dealing with the larger larval instars of all species, the soil moisture in the rearing jars was kept at a little under one-half the "sticky point" for the soil used. The older larval instars of all species can withstand considerable drying out of the soil.

Some writers (8 and 11) have pointed out that it is a relatively easy matter for the older wireworms of the species studied by them to adjust themselves to most unfavourable conditions and still survive, but the smaller instars are very susceptible to changes in environmental conditions. Lane (8) used this fact in formulating a control for *Ludius pruininus* Horn, var. *noxius* Hyslop.

The writer found it impossible to rear the wireworms, with which he was concerned, from eggs to adults without a knowledge of the environmental conditions desired by the younger instars of the different species. Younger instars of the different species might need very different conditions for their survival and normal development. For example, take the case of *L. variabilis* and *H. carinatus*. The larvæ of the former species, if they are to survive and develop normally, must have excessive soil moisture during the lives of the small instars. On the other hand, at the same room temperature, and under similar conditions, the small instars of *H. carinatus* cannot live; a moderately moist soil environment is needed in this instance. Ordinary drain pipes, sunk into the ground to a depth of 2 feet 6 inches and with brass gauze fixed to the lower ends, were at times also used as cages. These were filled with soil up to the level of the ground surrounding the pipes and, as far as practicable, the soil conditions inside the pipes were made similar to those of the surrounding soil. These pipes were placed in well-drained land and as a result it was found that they could not be used for rearing *L. variabilis* from eggs to adults under natural weather conditions, whereas they were, under similar conditions, quite suitable for this purpose so far as *H. carinatus* was concerned.[a] Larvæ of these two species are the wireworms most commonly found in cultivated cane fields in the Central Queensland mill areas.

During 1932, by dint of keeping the soil in the rearing jars at approximately its "sticky point" during the lives of the younger instars, the rearing of *L. variabilis* from eggs to adults was found to be a comparatively easy matter. Also, by providing the necessary conditions for the younger instars of most of the species of the genera *Heteroderes* and *Lacon,* and B sp., fairly satisfactory data concerning their larval lives were obtained. During this year (1932), however, very

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[a] A preventive control (9) of *L. variabilis* has been developed, and has proved very satisfactory where topographical and economic conditions are such that the necessary drainage can be done efficiently. This control is based on field observations and the fact that, more so than any other species of wireworm inhabiting cultivated cane fields in the Central Queensland sugar areas, the young instars of *L. variabilis* needs excessive soil moisture for their survival.

few of the smaller exuviæ were recovered from the soil in the rearing jars. Attempts to rear the young wireworms between pieces of damp filter paper, or in small pellets of soil between pieces of damp filter paper, were not successful; under these conditions no larvæ survived. During December, 1932, and during 1933, very small instars were successfully reared by using small salve tins (1 inch in diameter by ⅜ inch deep) as cages. By the help of the facts reported in Section B. (pp. 44-60) and inspections every second day, it was possible to recover most of the small exuviæ from the soil in these "salve tin" cages (for *L. variabilis* see Table VIA.). When larvæ were in the fourth or fifth stadium they were removed from these small cages to the 4-oz. jars.

Pupæ were seldom affected if removed from their pupal cells. When a pupa was found it was placed in a depression in the surface of the soil (after it had been pressed down) in its rearing jar. The final larval exuvium was very often found attached to the posterior end of a pupa from a larva of the semi-flattened yellowish type. Attachment is usually made by strings (mostly intima of the tracheæ) which have become entangled with the barbed spines at the extremity of the pupal abdomen.

As mentioned in Section B, four adults were obtained from twenty-four larvæ taken from rotted woods. Whilst collecting these larvæ it was observed that some were feeding on the internals of larvæ of the tenebrionid *Uloma westwoodi* Pasc.; when in captivity for six months their environment consisted of broken-up rotted wood, kept damp. As food they were provided with any wood-inhabiting tenebrionid larvæ available.

Measuring the Greatest Width of the Ventral Mouth Parts.

For this purpose use was made of a micrometer eye-piece and objectives of three different powers. Calibration was such that with objective (*a*) 4·25 divisions on the eye-piece scale equalled 0·2 mm., with objective (*b*) 3·0 divisions equalled 0·7 mm., and with (*c*) the measurements were in millimetres direct. When working with *L. variabilis* objective (*b*) was used for all instars, while for specimens of first instars set in slides, objective (*a*) was also used.

Whilst being measured the living larvæ were held on the microscope stage between two glass slides (for the larger instars) or between a glass slide and a cover glass (for the very small instars).

Summary.

1. The reliability of larval length, antennal segment ratios, head width, and the greatest width of the ventral mouth parts ((A-B) measurements), as criteria for determining larval instars of *Lacon variabilis* are discussed. Evidence collected during the rearing of this species from eggs to pupæ demonstrates that any of its larval instars can be recognised by the greatest width of its ventral mouth parts. The application of Dyar's Law to this species is discussed. The (A-B) measurements of a random larval population can be divided into well-defined groups of which each represents an instar. When the means of the groups representing the last seven larval instars are arranged in order of magnitude, it will be seen that they advance in arithmetical progression. The (A-B) measurements of the last seven larval instars of a single larva are also approximately in arithmetical progression.

There are normally eight larval instars in the life of *L. variabilis*, but a small percentage of the larvæ of this species pupates at the end of six larval stadia. The first larval instar is distinguished from all other instars, both by the shape of its ninth abdominal segment and the isolation of its (A-B) measurement when such measurements of all instars are placed in a regular series.

2. By the procedure of grouping the (A-B) measurements of a random larval population, calculating the means of the groups, and using the information as a guide during rearing work, it was found that for seven species of *Heteroderes* and for nine other *Lacon* species, each group represents an instar. Further, the means of the groups (with the exception of those representing the first larval instars) for each species advance approximately in arithmetical progression. As in *L. variabilis* so in all these species the first larval instars are easily distinguished from any other instars.

3. The distinctive appearance of any instar prior to ecdysis and the feeding habits of the larvæ under certain conditions were of practical help in placing to within a few days the dates of some of the ecdyses of the smaller and moderately-sized larvæ.

4. The larval stadia for *L. variabilis* are given; under Mackay conditions larval growth is usually more rapid during the earlier stadia. The larval growth rates of several other species of *Lacon* and several species of *Heteroderes* are similar to that of *L. variabilis*.

5. Technique used by the writer in rearing some wireworms is described. In this connection it should be noted that the critical point in the larval period of all the species with which the writer had to deal is the early instars. In the rearing of the larvæ from first larval instars to final larval instars, success was dependent upon providing the small instars with suitable environmental conditions. The early instars of different species may require, for their survival, quite different environments.

Thanks are due to Mr. Robert Veitch, Chief Entomologist of the Department of Agriculture, for his courtesy in making available the services of Mr. I. W. Helmsing, to whom credit for the preparation of the excellent illustrations is due.

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PLATE 6.

Large white baconers raised under grazing conditions on Mr. C. B. Peter Bell's Maroon Homestead Farm.

Buffalo Fly Control in North-West Queensland.

IN this article it is proposed to outline the methods adopted in North-West Queensland in an endeavour to check the eastward movement of the buffalo fly. But before considering control measures it is proposed to briefly discuss other features which will prove of interest to readers.

For the purpose of this article it is proposed to discuss the subject under the following headings:—

1. The History of Buffalo Fly introduction to Australia.
2. A summary of the life history and the habits of the fly.
3. Methods of control and a description of the machinery in operation in North-West Queensland.

Historical.

The buffalo fly (*Lyperosia exigua*) is a biting blood-sucking fly closely related to, but distinct from, the horn fly (*Lyperosia irritans*) which has caused such devastation in North America and the Hawaiian Islands.

It is thought that it first entered Australia from Melville Island, reaching the mainland with the first introduction of buffaloes in 1825. Three years later, in 1828, buffaloes were shipped to the mainland of Australia, and it is thought that from that time the fly first made its appearance in the Northern Territory in the vicinity of Darwin. With the gradual growth of the pastoral industry the fly has grown into prominence, and in 1912 Dr. Gilruth, the then Administrator of the Northern Territory and a Veterinarian, officially announced that the fly was existent there and might assume serious proportions. Since then many scientific observers have referred to the fly in reports following experience in the Northern Territory.

For some unknown reason the buffalo fly for a considerable time remained localised in the vicinity of Darwin, but of recent years, possibly on account of the fly having more fully adapted itself to changing conditions and environment, it has spread alarmingly, and the northern pastoral country of Western Australia, the Northern Territory, and parts of Queensland are threatened with invasion. Already, North-West Queensland is feeling the effects of the buffalo fly invasion, and not that alone but also the inconvenience which necessarily must follow in its wake, the observance of regulations enacted to control the movements of cattle.

Strange as it may seem Queensland was the last State to be invaded, and this is possibly explained by the fact that little movement of cattle took place into Queensland from the Northern Territory along the coastal stock routes where conditions of temperature and moisture are favourable to the propagation and spread of the buffalo fly. Most, in fact all, movements of stock took place over the Tableland country of the Northern Territory, entrance being made to Queensland at the Lake Nash crossing gate, some distance south of Camooweal.

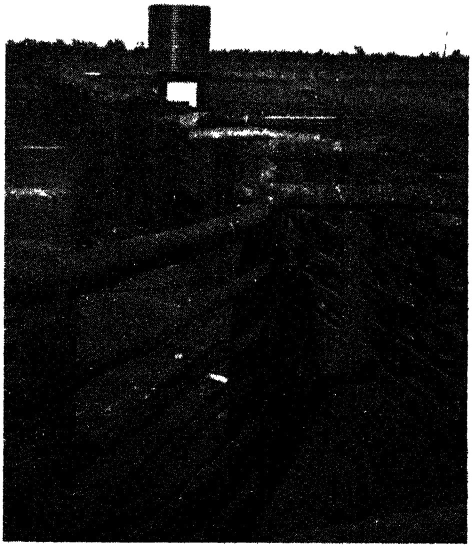

PLATE 7.
General view of spraying plant at Kajabbi.

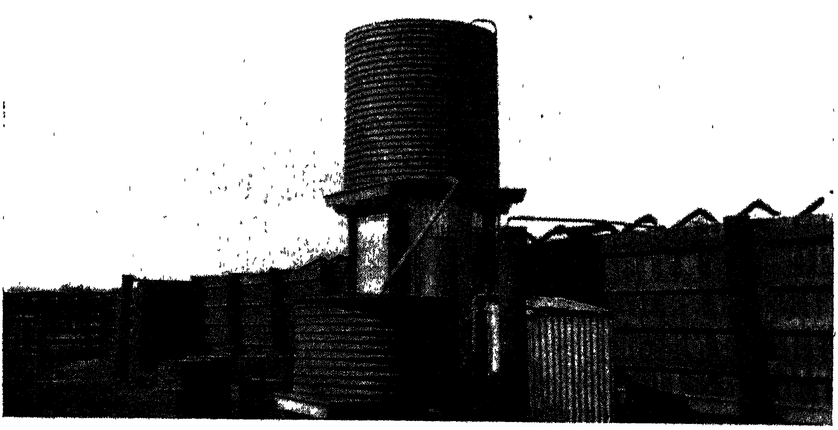

PLATE 8.
Side view of plant at Kajabbi, showing the boarded race, top reservoir tank, lower mixing tank, and right centrifugal pump. The engine is housed beneath the tank stand.

In crossing this long stretch of high open country, which experiences particularly cold snaps during the season in which cattle travel, it has been found that the buffalo fly tends to desert travelling stock. This is so since the optimum conditions of temperature and moisture are non-existent. Perhaps another factor has assisted to shield North-West Queensland from invasion earlier, and that is the roughness of the country on the Northern Territory border near the Northern Coast, which prevented natural movement of cattle in an easterly direction.

However, whether it was non-adaptation to Queensland conditions or natural barriers which temporarily arrested the buffalo fly, we are now faced with the fact that the whole of the cattle and dairying country of Northern Queensland is in jeopardy, and only the constant vigil of those in authority, assisted by the pastoralists themselves, can hope to check its fast movement eastward.

The Gulf country of Queensland, and particularly the low-lying coastal belt, is favourable country for the development of buffalo fly, since optimum conditions of temperature and moisture prevail, and the northern coast is thus considered the possible portal through which the rich and wealthy east coast is threatened.

Life History and Habits of the Fly.

In the Netherlands Indies the buffalo fly feeds on the blood of cattle, including zebus, and other races of native cattle, and also buffaloes, but not as far as is known on any other animals.

In Northern Australia, however, the fly attacks buffaloes, cattle of all kinds, horses, mules, donkeys, and in cases of gross infestation it may elect to attack man. Respecting cattle, it has been noted that it prefers bulls to bullocks, or cows, and perhaps dark-coloured beasts are more frequently selected by the fly, but it is certain that fine-haired smooth-coated animals are more frequently the subjects of attack than the long-haired and coarse type. In gross infestation, however, neither of these factors is of importance.

The female lays her eggs in bovine manure, the eggs being deposited in the cracks and crevices of fresh fæces. Here the stages of the life cycle are gone through, the egg developing into the larva, the larva to the pupa or cocoon, and finally the adult or imago stage is reached. Murnane, who made investigations for the Commonwealth Government on the buffalo fly question in North Australia, has stated that the entire life history may be completed in nine days. Hence, under suitable conditions, it is seen that commencing with a small infestation, a gross infestation could soon be experienced.

The adult fly is a slender insect, metallic grey in colour, and about half the size of the common house fly. This is contrary to the opinion that I have heard voiced by many people who suppose the insect to be of large proportions, possibly because of the name. But the name is only indicative of its original host, the buffalo, and has no bearing on its size whatsoever. It can be easily distinguished from the small bush fly so commonly found in the Gulf country. The small bush fly is black in colour, whereas the buffalo fly is much lighter in colour. When feeding on cattle the glistening wings are held projecting upwards at an angle from the body. When disturbed it rises quickly, but just as rapidly returns to assume its characteristic poise of outstretched wings.

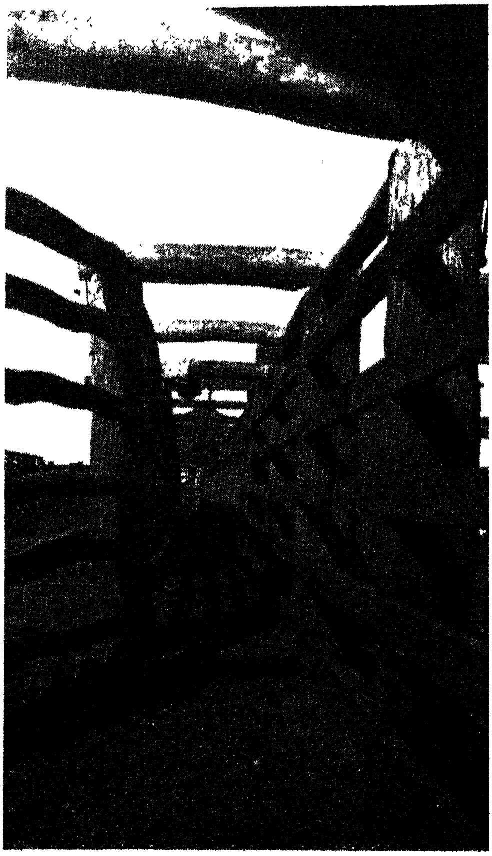

PLATE 9.
The spraying race from the entrance.

PLATE 10.
The loading race at Railway Siding.

Under natural conditions it favours certain parts of the body behind the poll and the base of the horns, the withers, the lumbar region, and low down in the sheltered portions of the flanks and ribs. Undoubtedly these protected parts are favoured since they are inaccessible to the continuous switch of the tail.

Upon careful examination the most striking feature of the fly is its proboscis, which forms a rigid tube-like prominence somewhat swollen at the base, and this is forced through the skin of the host like a needle. A pair of finger-like palps lie along the side of the proboscis. Frequent and heavy rains reduce the number of *Lyperosia* in the field by washing out the dung pads and making them unsuitable for the larvæ. Long dry periods desiccate the pads so quickly as to render them unfit for the developing larvæ. Under either of these conditions, the incidence of the fly decreases.

Seasonal Incidence.

The buffalo fly has a seasonal incidence, its numbers increasing enormously with the advent of the rainy season, which in North-West Queensland usually extends over the months December to March or April. By the end of the wet season and for a short time afterwards the fly is present in gross numbers. The conditions existing in July and August are not so favourable to its propagation, so it is found that in these months when the cold weather appears the fly infestation is at its lowest. With the rising temperatures onwards, until December, it will remain at the point of lowest infestation, but again with the onset of the wet conditions the incidence reaches its maximum.

Effects of Infestation.

When suddenly exposed to gross infestation, cattle have been observed to exhibit intense "fly" worry, evinced by restlessness, constant switching of the tail, and tossing of the head. On the other hand, cattle reared in infested country appear to gather a tolerance to the attack of the flies, although upon heavy infestation the worry is noticeable.

However, the fly exacts its toll in the quantity of blood that is drawn during feeding. When flies are present in countless thousands as they sometimes are, the loss of blood must be quite considerable, and the consequent loss of condition great. What condition is lost by this means it is not possible to estimate. Furthermore, the constant irritation and the endeavours of the animal to allay the irritation by rubbing against trees and other objects often leads to the formation of raw granulating wounds about the jowl and dewlap, and as in the case in many Hereford cattle, at the medial canthus or the inner corner of the eye.

There is one redeeming feature of the buffalo fly infestation and that is its seasonal incidence. It has been stressed that the fly is present in greatest numbers during and for a short time after the rainy season. At that time the grass is green and luxuriant, and with plenty of feed the strain on the growing animal is not so heavy. With the dry season, May to December, the infestation is at its lowest ebb, and it is fortunately at the time when the beef animal in the north is hard pressed to exist.

Methods of Control.

In the light of the experience gained by scientists the world over, it has been realised that the control of pests of all descriptions offers

PLATE 11.
Bullocks in the spraying race with plant working. Note the sprays above and below the animals on both sides.

PLATE 12.
The Leichhardt River, at Kajabbi, from the railway bridge, North Queensland.

numerous obstacles. This has been found to be the case in instances where a less active subject than a fly has entered into the picture, hence, remembering that the buffalo fly is a winged parasite, proved to be capable of flying a distance of 30 miles, the right thinking man can readily understand the difficulties which present themselves in devising methods of control.

Not only in Queensland has the difficulty been appreciated. Western Australia too has met similar obstacles, but in Queensland the difficulties are far worse.

In Western Australia it was early realised that a great risk was encountered in bringing cattle from the buffalo fly infested areas of the West and East Kimberleys to the south-west corner of the State, where the State's finest dairy farms are centred. Hence, a scheme was devised whereby cattle before shipment at the port of Derby were subjected to treatment with a substance which experiment proved to be lethal to the life of the fly, i.e., when coming in contact with the fly, it killed. This has proved successful insofar that the fly has not reached Fremantle, where cattle are unloaded since the institution of spraying facilities at Derby. But it must be remembered that the time taken for steamers to reach Freemantle from Derby is some ten days, and furthermore, owing to the presence of pleuro-pneumonia in the Kimberleys, it is compulsory to transport all cattle by sea, and during that sea voyage strong winds and cold conditions are encountered.

In Queensland, the position is a more complicated one. The only practicable exit from the buffalo fly infested areas is overland, and although similar methods of control to those employed in Western Australia have been used, it has been frought by tremendous difficulties. In short, a plant has been erected at a suitable spot, Kajabbi, which place is at the railhead at the terminus of the main stock route from infested area. Here cattle are subjected to treatment with a solution known to be lethal to the fly upon contact. Although the solution used is found to be lethal on contact, unfortunately experiments to date have failed to reveal a substance which on application has any lasting repellant action. Hence the position is that cattle, when once sprayed and placed on trucks, are subject to reinfestation with buffalo fly which choose to desert cattle still remaining in the receiving yards. Thus it is seen that the secret of handling cattle at the railhead is their expeditious trucking and their removal from the scene of operation in a thoroughly wet condition. It is thought that this difficulty has been overcome by the use of long hoses with an adjustable nozzle with which cattle on trucks are sprayed a second time, and their removal is made immediately after the second treatment.

Description of Plant at Kajabbi.

The loading of cattle at Kajabbi involves their passage through a long race leading from the drafting yards to the trucks. For the actual spraying, a specially boarded-in race is used, 108 feet in length, and provided with slide gates at its entrance and exit. The spray itself consists of three lines of 1¼-inch galvanised piping, one line placed overhead and two laterally—each running the whole length of the spraying race. These pipes are fitted with jets placed at 3-foot intervals, the lateral pipes being about 20 inches above the floor level, and the floor is concreted. The jets on the lateral pipes are set at an angle of

PLATE 13.
Rugged bank of the Leichhardt River, North Queensland.

PLATE 14.
Gregory River, near the crossing, Gulf Country, North Queensland.

45 degrees. Those on the overhead pipe are set to force the fluid in a direction straight down.

The fluid is forced through the pipes by means of a centrifugal pump driven by a petrol engine, and the jets capable of throwing a dense mist spray, which satisfactorily saturates each beast, the top sprays effecting the wetting of the backs and heads and the lateral jets the bellies and legs. Approximately 2½ gallons of solution are used for each beast. Cattle are passed into the race to its full capacity, and the pump set in motion, and the animals retained in the race for the minimum length of time to assure complete wetting. Following this the exit door is opened and the animals set in motion, whilst the jets are still in action. When the last beast leaves the race, the pump is cut off, the exit door closed, and the race refilled for the treatment of a second crush full.

Water is conserved in a 1,000-gallon reservoir tank, and is run into a 400-gallon capacity mixing tank, which is directly connected with the spray pipes.

It has been found that the plant at its present working capacity is capable of handling cattle as fast as it is possible to truck them, animals being confined in the spraying race for only three-quarters of a minute. The daily truckings are entirely dependent upon railway facilities, and the fact that trucking must finish in time to enable inspections to take place prior to nightfall.

Results of Spraying.

After spraying it has been the practice to make a series of inspections of cattle trains en route to their destinations. Fat cattle trucked to the east coast meatworks were subjected to as many inspections as possible during transit. In all instances the first examination was made at the spray, the second 30 miles distant, and the remainder at varying distances along the line.

It is pleasing to note that at no time following the double treatment, i.e., in the crush and with hoses on trucks, was buffalo fly found to be present. In many instances dead flies were recovered from beasts after the first treatment in the crush.

Treatment of Manure on Trucks.

When it is remembered that the female buffalo fly lays her eggs in the cracks and crevices of fresh manure, it is apparent that provision had to be made for the efficient disposal of manure. Where possible, destruction was carried out by treating used trucks with superheated steam at a minimum pressure of 160 lb. to the square inch. This method was made possible by the utilisation of a railway engine fitted with steam pipes attached to the steam box.

On occasions this most efficient device could not be availed of. In such instances all trucks were treated with a concentrated borax solution.

Horses and Camels.

Although bovines are the favourite host of the buffalo fly, it was not lost sight of that horses and camels are subject to attack. Consequently, similar treatment was applied to horses and camels leaving buffalo fly infested areas. When in small numbers it was not necessary to pass

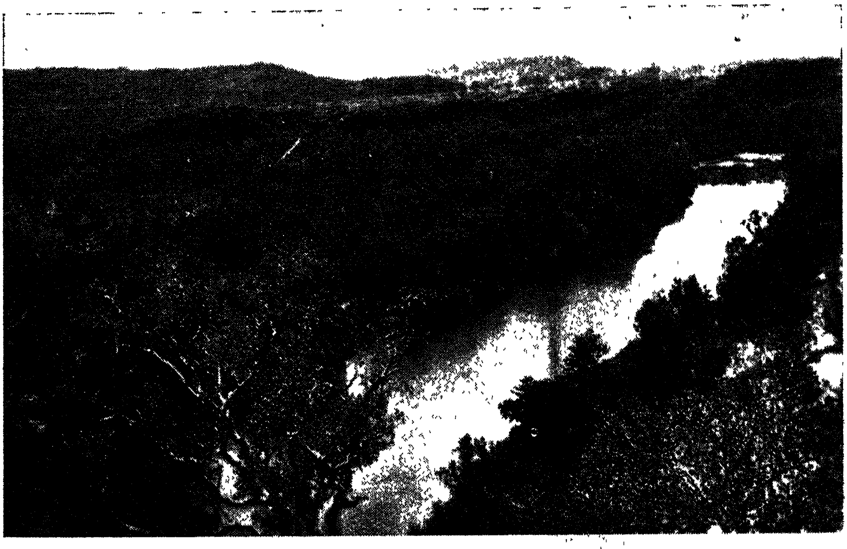

PLATE 15.
Lawn Hill Creek, Gulf Country, North Queensland.

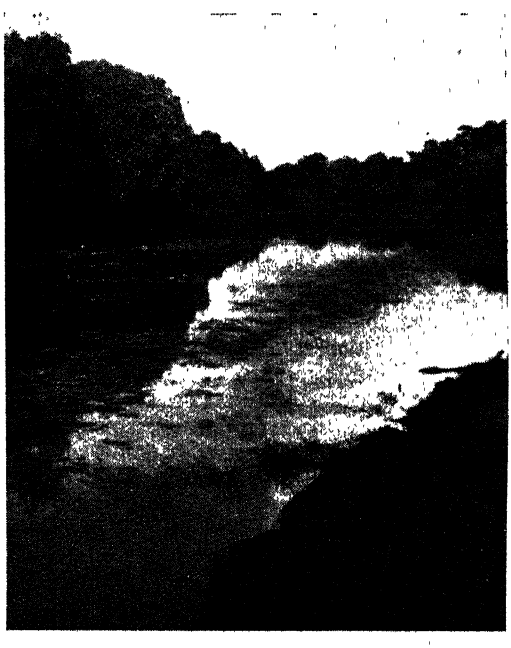

PLATE 16.
On the Smithbourne River, Gulf Country, North Queensland.

PLATE 17.
The Byrne River Crossing, Gulf Country, North Queensland.

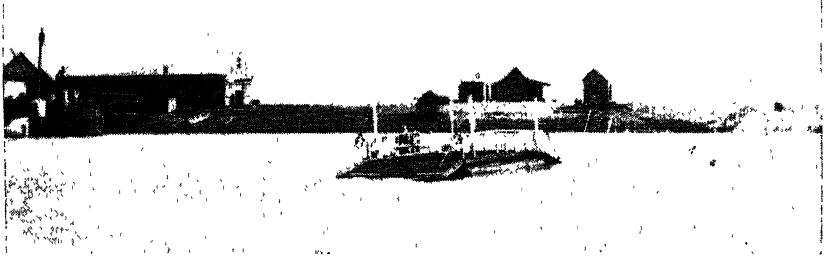

PLATE 18.
Vehicular ferry crossing the Norman River at Normanton.

PLATE 19.
The wharves at Normanton, Gulf of Carpentaria, North Queensland.

them through the race, and in fact the race was scarcely suitable for highly-strung horses or the long-necked camel. However, it has proved satisfactory to resort to their treatment with hoses only, in which case it has been found quite efficacious.

Conclusion.

In conclusion it must be emphasised that the matter of buffalo fly control is by no means an easy one. It must be remembered that the fly is a winged insect capable of flying considerable distances, and conditions in the Gulf country are suitable for its propagation.

The co-operation of all sections of the community concerned in those areas is essential if a legitimate attempt is to be made to hold the fly in check.

VALUE OF FODDER CONSERVATION.

Few dairy farmers in Queensland can claim that their cows are better butter-fat producers in times of drought than in seasons of plenty. Not many would be prepared to believe that it could be done, but Mr. Ben O'Connor, the veteran Australian Illawarra Shorthorn stud breeder, of Emu Creek, Colinton, has proved it more than once by following a few commonsense rules in farming.

The secret, he says, is fodder conservation. Mr. O'Connor is one of Queensland's most successful breeders of Australian Illawarra Shorthorn cattle, and this success he attributes to the strict observance of three rules: The buying of only the very best stock; liberal feeding; and the conservation of fodder, so that production might be maintained during the driest spell.

"In the first place," said Mr. O'Connor, "a cow that is not worth the best feed that can be grown is not worth keeping. Unfortunately, there are to-day too many dairy farmers in this State who have not yet realised that a low butter-fat producing cow is as expensive to maintain as a heavy yielder. There are just as many who refuse to look ahead and conserve for those inevitable droughts."

When Mr. O'Connor commenced dairying in the Brisbane Valley twenty-seven years ago he decided that the only way to succeed was to start off properly. The first task was to select a herd that would give a profitable return. This he did by travelling far and wide, visiting all the leading studs until he eventually acquired pedigreed stock of the highest quality, going so far as to pay up to ninety guineas for heifers. The result is that to-day Mr. O'Connor has a milking herd equal to any in the State. His fifty cows have returned him as much as £200 in one month.

This breeder severely culls his stock, so that quality will always be maintained. He is a firm believer in feeding his cows in stalls on lucerne chaff and maize meal, in addition to grazing them on lucerne, oats, and prairie grass.

Over 100 acres of Mr. O'Connor's property is cultivated for lucerne and maize, and any surplus growth is stacked for future use. Feeding in times of drought, under those conditions, is not much more expensive than in good seasons, and it is his experience that stock do better and give heavier yields.

Mr. O'Connor is one of the State's most successful dairy stock exhibitors. He claims the distinction of having won more champion group honours than any other breeder in the State. Between the years 1920 and 1929 his Australian Illawarra Shorthorn group was undefeated, and another outstanding performance was the winning some time ago of the champion group, open to all breeders, at the Gympie Show, for a prize of £100. This was carried off by Mr. O'Connor after his cattle had won the event three times out of four. On the fourth occasion the group was runner-up.

The noted Charm of Glenthorn was one of Mr. O'Connor's cows. This beast had over twenty championships to her credit, including the State honour at the Royal National Show, where she also secured the State butter-fat production championship, retaining the title for some time, only to be beaten by the present holder, Elsie IV. of Oakvale, who is her herd mate. This breeder's herd of fifty cows has repeatedly given a yield of 200 gallons of milk daily.—"The Queenslander."

Queensland Weeds.

By C. T. WHITE, Government Botanist.

Gomphrena Weed (*Gomphrena decumbens*).

Description.—An erect, much-branched annual herb mostly about 1 foot to 18 inches high, with a fairly stout tap root, and often rooting at the lowermost nodes. Stems in the upper or younger parts covered with numerous fine white hairs, which disappear almost entirely from the lower or older parts. Leaves somewhat elliptic (obovate-lanceolate) in outline, $\frac{3}{4}$-inch long, tapering at the base into a short leaf-stalk or petiole, smooth above, hairy beneath. Flowers white, borne in oblong or somewhat globose heads, $\frac{1}{2}$–$\frac{3}{4}$ inch long and $\frac{1}{2}$ inch across, lengthening in seed to spikes $1\frac{1}{2}$–2 inches long. Individual flowers $\frac{1}{4}$ inch long, composed of five white, semi-transparent, pointed perianth segments, surrounded at the base by a dense covering of long, white, silky hairs, each flower subtended by a bract and bracteoles, the former much broader and shorter than the latter, but sharply pointed. Seeds dark chestnut brown, smooth and rather shiny, round and flattened, 1 line in diameter.

Distribution.—A native of Mexico and Tropical America, now a naturalised weed in several tropical and subtropical countries. It is reported to have first made its appearance at Townsville about three years ago, having been noticed in a spot where some circus elephants had been feeding. It is now, however, very common along the whole coastal belt, and I have seen it as far inland as Torrens Creek.

Common Name.—I have not heard a common name applied to it.

Botanical Name.—*Gomphrena* from Gomphræna, a name used by Pliny for some plant of the same family (*Amarantaceæ*) from *grapho* I write or paint, in allusion to the highly-coloured foliage. Some plants allied to the present one are much grown in gardens on account of their coloured foliage, e.g., Alternanthera, Amarantus, Iresine, &c.; *decumbens* Latin for decumbent or reclining—in botany decumbent means reclining in the lower part, the upper part ascending or erect.

Properties.—The plant is probably quite a good fodder, though reports from different parts of the State regarding its palatability for stock are very conflicting. Stock on the whole would probably reject it or eat it only in limited quantities when plenty of other feed was available.

Eradication.—So far as I have observed the weed is not a particularly aggressive one, and does not call for any special means of eradication.

Botanical Reference.—*Gomphrena decumbens Jacq. Hort. Schœnb.* t. 482.

Acknowledgments.—I am indebted to the Director of the Royal Botanic Gardens, Kew (England), Sir A. W. Hill, for the specific determination of this plant.

PLATE 20.
GOMPHRENA WEED (*Gomphrena decumbens*).

The Peanut Industry.

A SOUTH BURNETT CO-OPERATIVE ENTERPRISE.

DOMINATING the whole town is the imposing storage and treatment plant of the Queensland Peanut Crowers' Co-operative Association —that is the first impression of a visitor to Kingaroy, a thriving centre of the South Burnett, one of the most productive provinces in Australia.

The first season in which peanuts were grown to any extent for commercial purposes in Australia was 1924, and the crop was practically all grown in Queensland, which is now regarded as the State most suitable for peanut cultivation. Very small quantities of peanuts are grown in the Northern Rivers district of New South Wales and also in Western Australia and the Northern Territory, but about 80 per cent. of the total Commonwealth crop is produced in the South Burnett district of Queensland, with Kingaroy as the centre of activities.

A marketing board was created in 1924 at the instigation of the peanut growers of Queensland. This board was formed under the Primary Producers' Organisation and Marketing Acts to have jurisdiction over all peanuts grown in Queensland for sale; and it has done much to foster, extend, and stabilise this industry. The following figures will show how the industry has increased under the control of the Queensland Peanut Board:—

Season.	Growers.	Acres.	Tonnage.	Value of Crop.		
				£	s.	d.
1924	100	691	231	10,657	10	8
1925	86	450	142	7,024	0	9
1926	250	3,000	827	38,418	4	2
1927	358	6,500	2,246	79,711	0	5
1928	557	11,500	2,886	107,930	13	8
1929	387	5,500	3,618	116,400	9	1
1930	250	2,300	727	25,773	12	6
1931	428	5,000	2,673	103,334	13	9
1932	216	2,000	551	18,788	13	10
1933	307	2,700	1,205	38,255	4	8
1934 Estimates	500	10,000	3,000	..		

The production in 1928 and 1929 seasons was more than could be absorbed in the Commonwealth, and, as exporting was not profitable, this led to a restriction of areas in 1930 in an endeavour to bring the industry back to normal conditions.

In 1928 the growers took advantage of the Primary Producers' Co-operative Association Acts in order to form the Queensland Peanut Growers' Co-operative Association Limited, and at the same time growers levied themselves at the rate of ¼d. per lb. of peanuts in order to provide storage and treating machinery. The levy was first deducted by the Queensland Peanut Board from the final payment on the 1927 crop and handed by the Board to the Association.

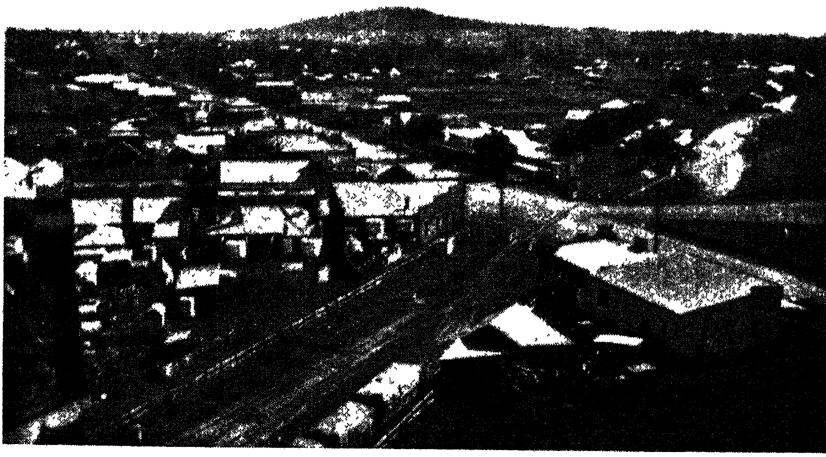

PLATE 21.

A view of Kingaroy from top of the peanut growers' silo, looking towards Mount Wooroolin, a beautiful park reserve left in its natural state.

Little more than thirty years ago the site of Kingaroy was a cattle station paddock. It is now one of the most solid farming centres in Queensland.

Bulk, storage, equipped with the most modern machinery known for the treating of peanuts for marketing, was erected at Kingaroy at a cost of £55,000, the Queensland State Government guaranteeing

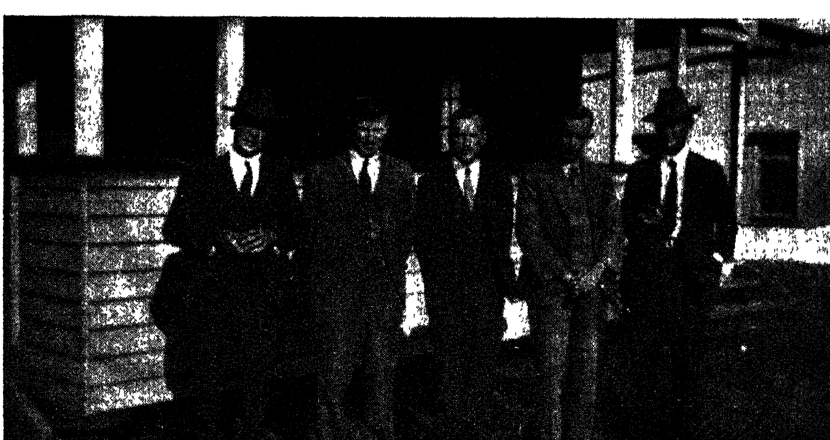

PLATE 22.

Members of the Queensland Peanut Board (left to right).—Messrs. N. J. Christiansen (chairman), C. F. Adermann, A. G. Whiting, L. Cain (Government representative), and N. A. Nielsen.

75 per cent. of the loan. The balance was raised from the 1927 levy, supplemented by the issue of preference shares in the Queensland Peanut Growers' Co-operative Association Limited. The storage capacity of the silos is 2,800 tons; while in a long shed known as the Dump, a further 1,200 tons can be stored, making a total storage capacity of 4,000 tons. The machinery consists of several cleaning

PLATE 23.

Silo, Dump, and Office of the Peanut Growers' Co-operative Association at Kingaroy. The storage capacity of Dump and Silo is 4,000 tons.

PLATE 24.—A PEANUT FIELD, SOUTH BURNETT, QUEENSLAND.

Probably no other district in Australia can surpass the record of the South Burnett in rapid settlement and development, and the relative volume of wealth production.

PLATE 25.—A PROMISING PEANUT CROP NEAR KINGAROY.

In peanut cultivation, as with other field crops, South Burnett farmers have established high standards in agriculture.

PLATE 26.—PEANUTS STOOKED READY FOR THE THRASHER, SOUTH BURNETT.

From Nanango to Goomeri and from the western slopes of the coastal range to the Bunya Mountains are belts of rich vine jungle land, alternating with stretches of fine forest country, containing extensive alluvial flats along numerous tributaries of the Burnett River. The natural agricultural richness of this region is

machines which treat the nuts from the farm at the rate of 10 tons per hour or 6 bags per minute, and grading and shelling machines with an out-turn of 3 tons per hour.

Until 1930 Queensland growers had been growing the Spanish variety of peanuts almost exclusively, but the Queensland Peanut Board undertook to supply also the Virginian Bunch variety for the roasting trade. In order to assist the Board in this endeavour, the Federal

PLATE 27.
A Peanut Thrasher at work on a South Burnett Farm.

PLATE 28.—AT THE END OF THE HARVEST.
Peanuts are trucked direct from the thrasher to the silo.

PLATE 29.

Inside the silo. Top conveyor and feed to bins.

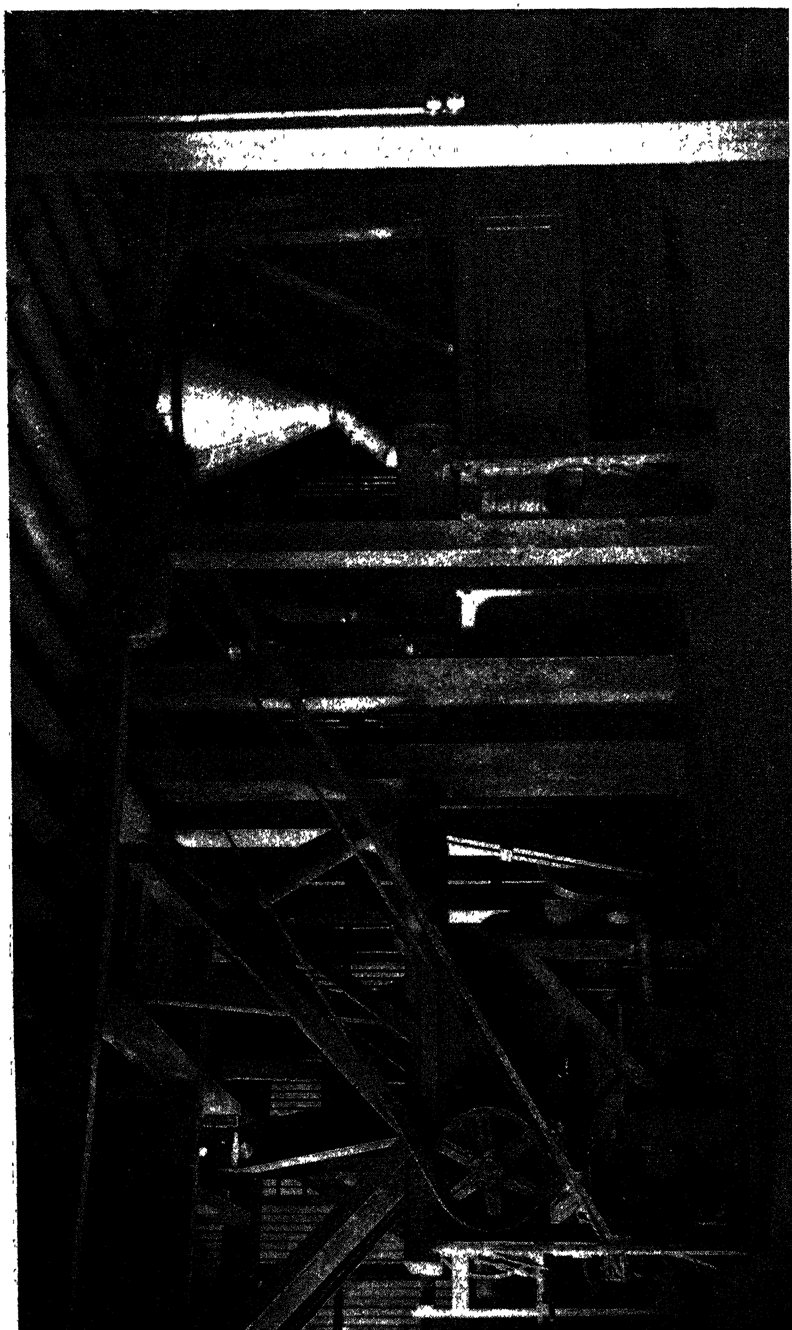

PLATE 30.
Graders and desheller, Kingaroy Peanut Silo.

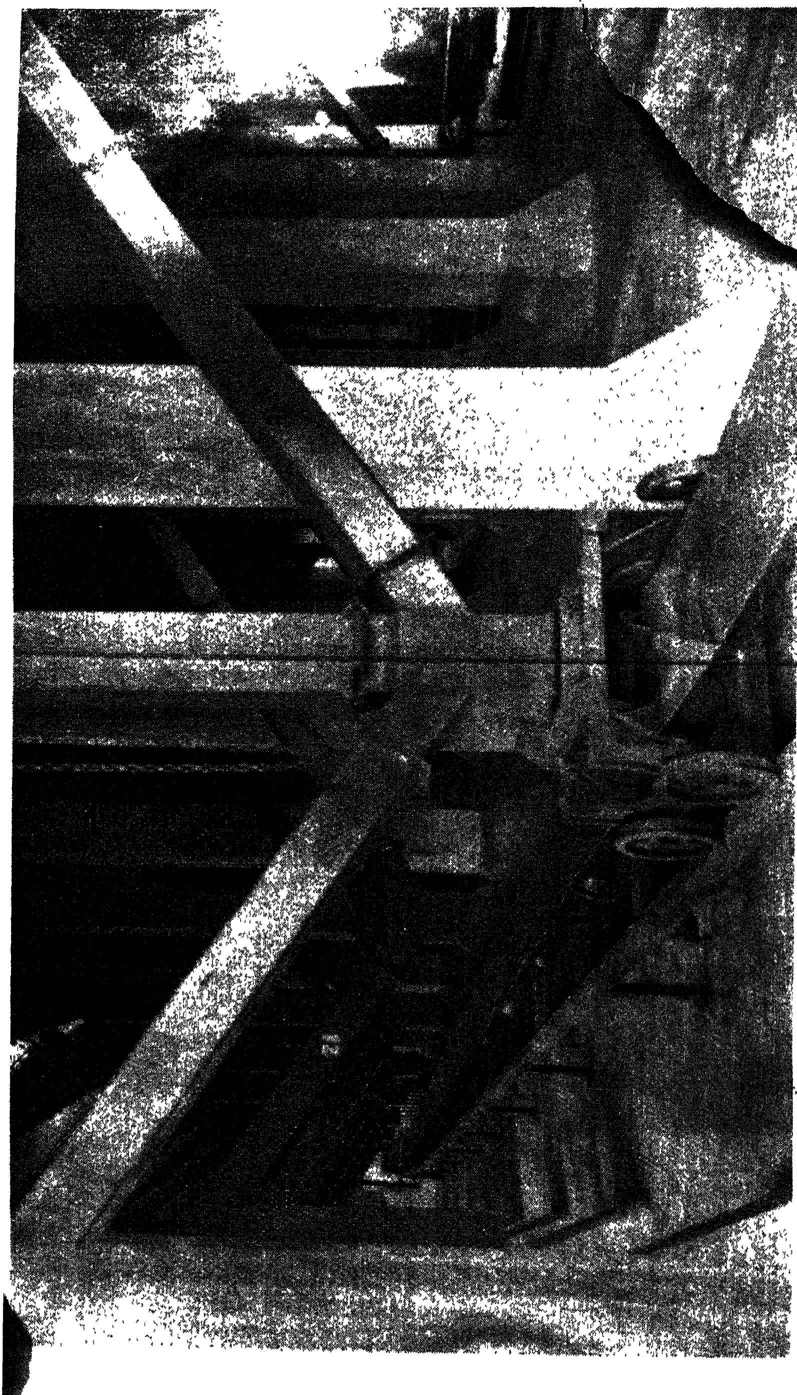

PLATE 31.—CONVEYOR BANDS, KINGAROY PEANUT SILO.

Vast bulk storage, equipped with modern machinery, for the treatment of peanuts for marketing at a cost of £55,000, provide an excellent example of farmers' co-operative enterprise in Queensland.

Government granted an embargo from 1929 to 1930, but, unfortunately, more peanuts were imported into the Commonwealth during the period of that embargo than during any corresponding previous period without an embargo. In 1930, the industry was granted an embargo for an indefinite time.

The 1932 crop was spoiled by dry seasonal conditions in the peanut-growing areas, with the result that there was a shortage of crop and the Board arranged with the Federal Government to permit merchants to import their requirements until the 1933 Queensland crop became available. A certain lack of confidence on the part of growers was responsible for another small crop in the 1933 season, and the Board had again to ask permission to import in order to allow the merchants to retain and supply their customers. This permission was granted

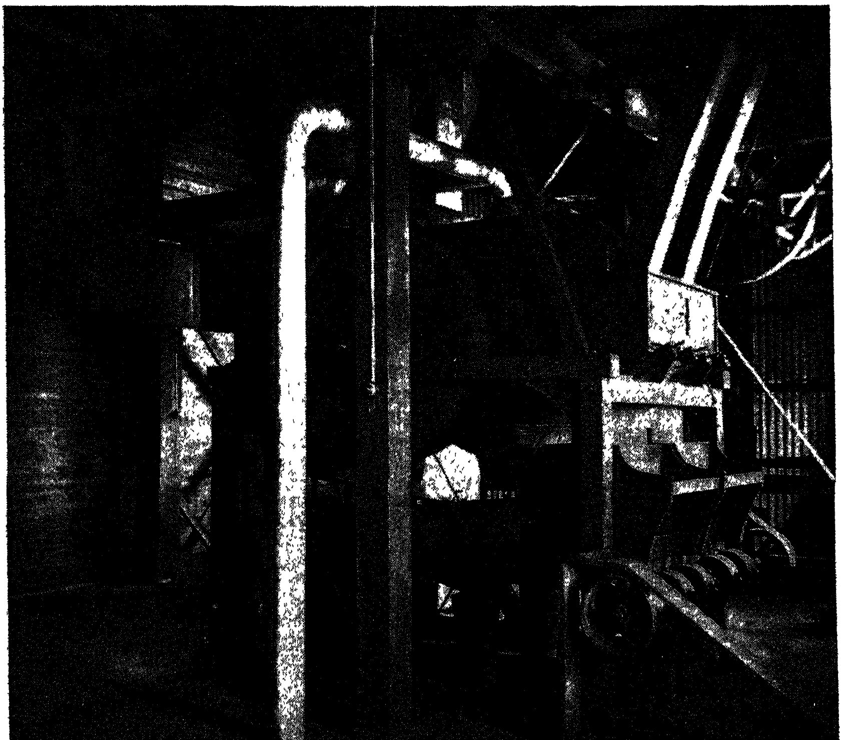

PLATE 32.
Final cleaning machine, Kingaroy Peanut Silo.

and the Board, confident of the continuance of the Federal embargo, encouraged growers to plant heavily for 1934 season. The growers, accepting the Board's advice, planted heavily, and were greatly disturbed when the embargo was lifted in December, 1933, after 10,000 acres had been planted. Since then, a very strong case was placed before the Federal Tariff Board for an increase in duty on peanuts in the shell. No decision has yet been given on this question, but peanut growers consider it necessary that an increase should be granted in

order to stabilise the industry. Queensland peanut growers have, to date, been levied since 1927 to the extent of more than £37,000 and have honourably met all their obligations. In 1933 the Queensland Peanut Board employed 21 males and 156 females apart from the office staff, but this year, with a crop about three times that of last year, only 20 males and 90 females are employed. The lifting of the embargo

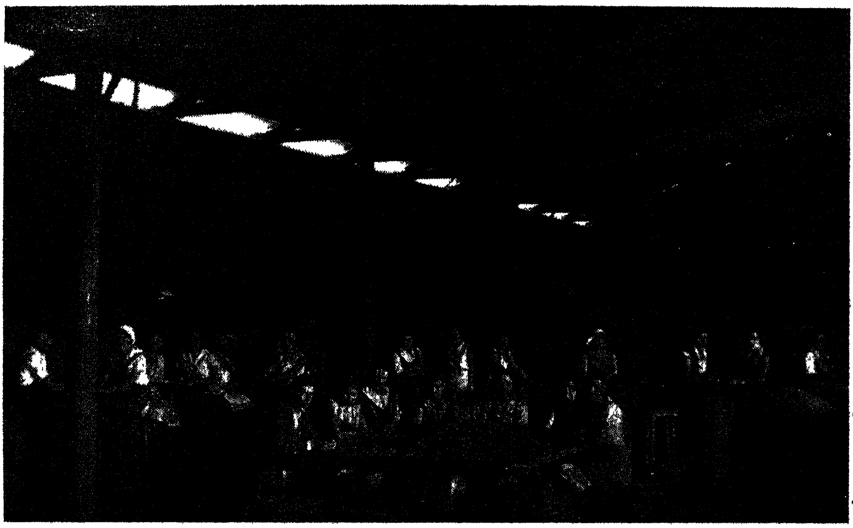

PLATE 33.—GIRL GRADERS AT WORK, KINGAROY PEANUT SILO.

In this work great skill is acquired, and the deftness of these cheerful workers is remarkable. The girls are mainly the daughters of district farmers, and represent fine types of Australian womanhood.

PLATE 34.—THE MOISTURE TESTER AND OPERATOR, KINGAROY PEANUT SILO.

may affect the grading staff principally, as these employees are engaged in the grading of the crop for the roasting trade, that is, the side of the peanut industry which is concerned mostly with overseas competition on the home market.

The wages bill of the Board and the farmers has in the past approximated £30,000 to £40,000 per annum, while manufacturers throughout the Commonwealth employ many hands and pay in accordance with the industrial awards of the different States.

Despite the depression prevailing throughout the world, the peanut industry in Australia has continued to expand and sales kept increasing until 1932, a record year from the selling point of view, and has almost completely disposed of previous surpluses.

In 1933 the Queensland Peanut Board opened a depot at Atherton to deal with the North Queensland crop, while, except in the period 1931-1932, the Central Queensland crop has always been handled in Rockhampton.

Visitors to Kingaroy are assured of a welcome at the silos which are evidence of the importance of the industry and its value as a factor in our rural economy.

SOUTH BURNETT.

Probably no province in the whole Commonwealth has a greater record of rapid settlement than the South Burnett, of which Kingaroy is one of the major centres. This rich district extends, roughly, from the Bunya Mountains and the high lands rimming the Northern Darling Downs on the south to the Kinbombi Range on the north, and from the Coastal Range on the east to the Boyne River on the west.

Thirty years ago it was mainly pastoral land, alternating with vast belts of dense vine jungle (miscalled scrub) or rain forest country. The jungle lands carried immense stands of hoop pine, and, in some parts, fair stands of red cedar. Round about Nanango and Coolabunia were the beginnings of closer farming settlement. The potential agricultural wealth of the district attracted settlers from other parts of Queensland, as well as from the Southern States. Nanango, one of the oldest towns in Queensland, then a pastoral and timber centre, to which gold mining to a small extent was also a wealth contributor, took on a new life. Kingaroy became a thriving terminus. Wondai was still a ''one-horse'' village. Murgon and Goomeri were merely names on the railway guide. Along the line new townships were gradually taking form.

To-day, Nanango (now a railhead), Kingaroy, Wondai, Murgon (an important railway junction), and Goomeri are populous commercial centres of the rich South Burnett, famed far and wide for the quality, volume, and value of its dairying, agricultural, pastoral, and timber production. Fine public buildings, electric light, and golf links are common to every centre. Several have aerodromes, and one, Murgon, an aviation club. Good roads radiate through their tributary territories; farms and towns are linked by telephone; and on every side are many evidences—including high schools, convent schools, and rural schools—of great cultural and material progress. In every part of the district there is an air of definite, although strenuously acquired, prosperity. It is scarcely believable that such extraordinary development—the clearing and cultivation of such vast areas—is the work of a single generation. The South Burnett was the land of the young man. Its pioneers are still comparatively young men, and in every branch of rural enterprise they have made their mark. Their dairy cattle and other live stock are represented in every important show ring. Their butter has gained the highest awards in State and Empire competitions. Their maize is equal to any grown in Australia; and they have established, and maintain, high standards in other branches of primary production for which district conditions are suitable.

The soils of the South Burnett range from the lighter loams to the deep, rich red and cocoa-coloured volcanic deposits of its jungle regions, and to the heavy black alluvia of its forest country. Added to all these advantages are a healthy climate and a wealth of scenic interest and beauty.

The Cultivation of Maize.

By C. J. McKEON, Instructor in Agriculture.

MAIZE is grown extensively in Queensland along the coastal areas and inland within the 30-inch rainfall region, the chief districts being Moreton, Wide Bay and Burnett, and Darling Downs, which among them usually produce over 80 per cent. of the State's total crop. The next district of importance is the Atherton Tableland, which, due to the comparatively safe rainfall, has much the highest yield per acre over a number of years. It will be seen from this what a vast area of Queensland is suitable for the production of this crop, and also the wide variety of soils on which it is being successfully produced.

Providing the rainfall is sufficient, and the land is naturally well drained, maize can be grown on any good quality soil, the alluvial flats found along rivers and creeks and the deep volcanic soils being particularly suitable for its growth. Good drainage is absolutely essential, for maize will not stand wet feet.

It is one of the easiest crops to grow, and, unfortunately, advantage is frequently taken of this fact, and many crops are grown under conditions which would be fatal to many other crops.

To get the best results maize requires a good soil, in which a plentiful supply of plant food is available, a condition which can only be brought about by an early and thorough preparation of the land before planting, attention to the cultivation of the crop itself, and to the eradication of young weeds during its early growth.

The land should be ploughed to a depth of at least 9 inches during the winter, and allowed to lie in the rough until the early spring. The action of the frost and rain will have a sweetening effect on the soil, and will leave it in a mellow condition. In the early spring the land should receive a second ploughing, which, if possible, should be a cross ploughing. This should not be so deep as the first ploughing, and should be immediately followed by a harrowing and cross harrowing to work the surface soil into a nice fine condition.

If a crop of weeds is turned under during the second ploughing planting should not be carried out for a few weeks at least to allow decomposition to take place. On land which is not too heavy and moist this will be greatly assisted by rolling, as the rolling will consolidate the soil and cause the decomposition to take place much more quickly. It will also at the same time make a good firm seed bed. Rolling should always be followed by a light harrowing.

Preparation of Seed Beds.

The preparation of the seed bed is one of the most important points in the production of maize, and no amount of after cultivation will undo the damage that has been caused by planting in a badly prepared piece of land.

One has only to see the difference, not only in growth but in the colour of the foliage also, between crops grown side by side, and where one has been sown on thoroughly prepared and the other on hastily prepared land, to realise how great the effect is.

Give the young crop a chance to become well established in a good seed bed—and by a good seed bed is meant not only a well-prepared one but one in which the young plants will not have to battle with a host of weeds—and the increased return will more than compensate for the extra time and labour spent.

When to Plant.

The best time to plant naturally varies according to the different districts. In districts which have a long growing season and a comparatively regular rainfall, this can be carried out whenever weather conditions are suitable, from August to late December.

Two very important points are—firstly, to choose a variety which is suitable for the district in which it is to be grown; and secondly, to plan to have the crops tasselling at a time when there is usually a good chance of getting rain. Maize must have moist conditions during tasselling, and if hot dry winds occur during this period the pollen is destroyed and fertilization cannot take place.

Seed should be sown in drills spaced from 3 feet 6 inches to 4 feet apart, nothing less than 4 feet for the tall-growing, late-maturing varieties. As a general rule, single spacing gives the best results, the grains being dropped singly along the rows, with a distance of approximately 12 inches between the grains for the quick-maturing varieties and from 15 to 18 inches for the late-maturing varieties.

From 9 lb. to 10 lb. of seed is sufficient to plant an acre when sown in this manner.

The most satisfactory method of sowing is with a seed drill, as in this way it is possible to get a good even spacing, and no loss of moisture occurs during planting, as is often the case where furrows have to be opened up for hand planting.

Field Practice.

The land may be lightly harrowed even until the plants are a few inches high. This will not only destroy young weed growth, but will also greatly improve germination in the event of heavy rain falling shortly after planting and causing the surface soil to become caked. Many growers are afraid of injuring the young crop, but if harrowing is done on a bright warm day, when the young plants are not brittle, and care is taken to prevent dragging of rubbish which may collect under the harrows, the crop not only will not be injured but will be greatly benefited.

In districts where the rainfall is heavy, and difficulty is experienced in keeping weed growth in check, many growers before planting run out shallow drills a few inches deep with a light plough or other suitable implement, and then sow along the bottom of the drills with the planter. When the young plants are high enough the cultivator is worked through the rows, and is set in such a way that the soil is drawn in around the plants, filling up the depression made when drilling, and thereby smothering the young weeds which have sprung up in the rows. This, of course, to be effective must be done while the weeds are very young.

During the early stages of growth the crop should receive at least two good inter-row cultivations to keep weed growth in check and to keep the surface soil in a nice friable condition, and on no account should the surface soil be allowed to remain in a caked condition while it is possible to work a horse cultivator in the rows.

Harvesting.

The picking of the crop still remains a hand operation, and although machines have been tried, one of which was invented and built in Queensland and which performed well at the trials, none of these has so far reached a stage where it can be successfully worked in the majority of crops.

The ears should be allowed to dry out thoroughly before being shelled, for, apart from the fact that the grain if shelled too early is likely to heat in the bags, a large quantity of grain is broken and damaged during the shelling process and the appearance of the sample is spoiled. A considerable wastage also occurs through the cores being too soft to withstand the pressure of the drums, and these break up into small pieces and pass out through the machine with the grain still attached.

Cost of Production.

To make maize-growing profitable the cost of production has to be reduced to a minimum, and this can only be done by increasing the yields by the use of pure strains of seed which have proved suitable for the locality, and also by practising the best cultural methods. Good quality seed not only gives an increased yield per acre, but also an increased return per bushel, as a better price will always obtain for grain which is of good even type and colour.

The use of modern machinery also is important in lessening the cost of production, and hand work must be eliminated wherever possible; the combined husker and sheller has done a great deal towards this.

Storage.

Maize may be stored for very long periods at no very great cost other than the initial cost of the tanks, yet growers frequently dispose of their entire crops for very low prices during flush seasons; whereas if they had the storage accommodation, and, of course, were in a financial position to store their grain for a time, they would receive very much better prices. One thousand gallon tanks are very suitable for this purpose, and hold approximately 3½ tons of grain. The lids of the manhole and shoot should be so constructed that they can be made quite airtight by puttying or by the use of puddley clay. First and foremost the grain should be dry, and should not contain more than 14 per cent. of moisture at the time it is placed in the tank.

If the grain is showing signs of weevil it can be fumigated by placing a couple of saucers on the top of the grain and pouring into these 1½ to 2 lb. of carbon bi-sulphide. Place the lid on as quickly as possible and puddle up the edges of the manhole cover to make it perfectly airtight. The tank should be kept sealed for twenty-four hours, or longer if desired, and then remove the lids from the manhole and discharge shoot and cover the discharge shoot with strong gauze to prevent the grain from running out. After forty-eight hours the covers can be put back.

Grain for seed purposes should not be left for such a long period, and should immediately after fumigation be exposed to the air, otherwise the germination may be seriously affected.

Carbon bi-sulphide is highly inflammable, and care should be taken to see that no lighted pipe or other naked light is near the tank when the fumes are released.

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As about 1,000 subscriptions expire each month, the cost of a postal reminder is, in present circumstances, prohibitive. Readers will, therefore, appreciate that fact, and will, no doubt, help us to retain their names on our mailing list by kindly noting the date of payment of their subscriptions and, on expiry, sending in their renewals at once.

Instead of just sending the annual subscription—one shilling—along, it is suggested that, when renewing, they do so for two or three years, or even a longer term. For instance, FIVE SHILLINGS would keep a name on our subscribers' register for FIVE YEARS.

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Readers renewing their subscriptions should USE THE ORDER FORM on another page, which should be filled in FULLY and CORRECTLY. Renewals by letter do not as a rule give the essential information, thereby causing unnecessary waste of time and much inconvenience. The Form is also our record, and orders which come by letter require special handling to adapt them to our card recording system.

When an address on the Order Form is not that to which the Journal has hitherto been sent, attention should be called to the new address, and the former address given. This assists us to identify subscribers, of whom we have many of the same name, often in the same district, as well as in different parts of the State.

Women subscribers should add to their names the word "Mrs." or "Miss," as the case may be. This is a constantly recurring omission, and its correction causes a lot of unnecessary labour in checking electoral rolls and other references. Wives and children of subscribers should apply in the subscriber's name, and so facilitate registration.

Progress of the Pig Industry

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PIG raising is now well established over the eastern portion of the State extending from Stanthorpe in the south to the Atherton Tableland in the far north and as far west as Roma, taking in the South Coast, the near North Coast, the Brisbane and Lockyer basins, the whole of the Wide Bay and Burnett, and parts of the Dawson Valley and Central Queensland. Thus, from the far northern highlands, famed for their fertility and generous seasons, right down to the southern border—a stretch of nearly 1,200 miles—pigs are farmed on a commercial scale. Bacon factories—proprietary and co-operative—and meat export works are spaced at convenient intervals throughout the pig-raising country, and continuity of supplies ensures for them a reasonable run of work throughout most seasons of the year, their joint output of bacon and hams for the year 1933 being over twenty million pounds. Thus, in its primary and secondary phases, the pig industry provides a livelihood for populous farming communities, and gives employment to a large number of highly skilled workers.

The principal breeds used are of British origin—the Berkshire, Tamworth, Large White, and Middle White—in the sale of the progeny of which a state of healthy rivalry exists between supporters of the several breeds. This competitive spirit is catered for in the pig sections of agricultural shows throughout the State, and especially at the Brisbane Royal, where the display of stud pigs would stand comparison with that featured at any show here or abroad.

Within the industry ceaselessly working to maintain present efficiency and to effect improvements wherever opportunity offers are a number of organisations—societies representative of all pig industry interests. Especially has the co-operative effort been developed among pig raisers, resulting in the establishment of up-to-date and highly successful co-operative bacon factories both in the metropolitan, Darling Downs, and North Queensland areas. Proprietary factories both on a large and small scale have grown up with the industry, and in more recent years the establishment of the Brisbane Abattoir, and extension of operations there and at other meatworks to provide for the export

trade in frozen pork and for a wider distribution of pork products on the local market, has meant an immense amount to the industry.

Climatic Conditions and Environment.

It is worth stressing here that we are indeed fortunately located from a climatic point of view in comparison with older and colder countries of the world, for our climate certainly favours the open-air system of stock raising; and this system, plus our environment, enables progress to be made with less financial outlay than where winters are long and cold and more intensive housing and feeding is necessary.

Doubtless it is this, plus strict quarantine measures, that has kept the country free of such scourges as foot and mouth disease, trichinosis, pork measles, rinderpest, swine fever (hog cholera), swine erysipelas, and other serious pig diseases.

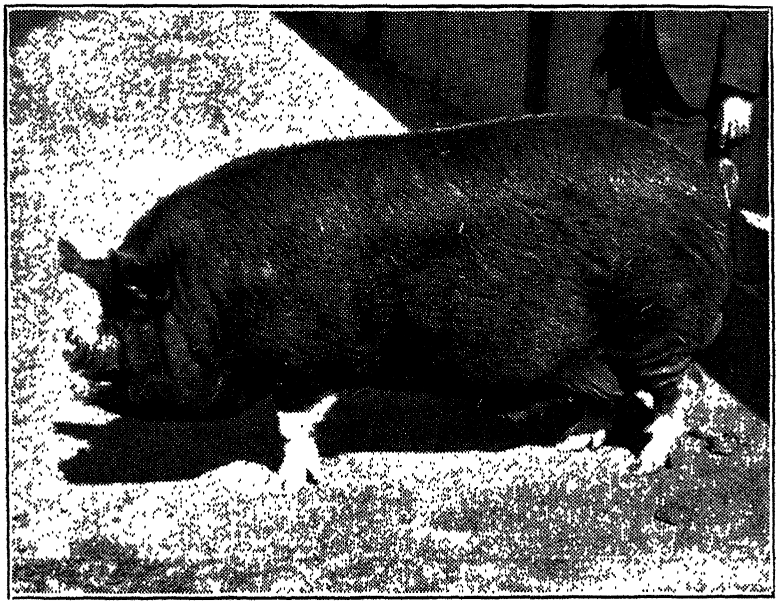


PLATE 35.

The Champion Berkshire Boar at the Sydney Show, 1934. Now the property of Mr. J. Barkle, of Kingaroy. This boar has already added to his laurels by winning several championships in keen competition in Queensland.

With such a favourable environment, it is not to be wondered at that the industry has developed so remarkably and that the good reputation of Queensland's pork products, and especially frozen pork, on the overseas markets is being well maintained.

A favourable location, reasonably good seasons, and a constant and expanding market for the products of the business are all essential to the progress of primary industry, and as Queensland is possessed of all these attributes she ranks to-day as the foremost pig-producing State of the Australian Commonwealth.

As with other branches of rural industry, the production of pigs is a specialised business, requiring knowledge and application.

Similarly, it is probable that if there were less dependence upon milk as a food and greater extension of the use of cereals (carbohydrates), plus vegetable and animal foods (proteins), the pig industry would be placed on a safer foundation and expansion of local and export trade would be expedited.

In other words, these feeding experiments aim "to provide data relative to pig nutrition and for purposes of pathological experiments in the feeding and handling of market pigs, and to provide suitable stock for marketing as export porkers or baconers in co-operation with the Queensland Meat Industry Board."

The system of pig raising in conjunction with manufacture of dairy products, in which pigs are fed on factory by-products—buttermilk (or whey)—and on grain, greenstuff, minerals, and water, occupies a very important place in the economic life of the industry, and thousands of pigs are fed and marketed each year from commercial pig farms of this type.

Pigs bred on farms where they are fed on waste food from hotels, cafés, produce markets, and manufacturing establishments contribute a liberal quota each year to pig industry statistics, and have their place in the economy of the industry. Although this system is not at present as extensively carried out in Queensland as in the more populous southern States, there are numerous suburban and metropolitan piggeries around Brisbane and provincial cities. The two lastmentioned systems require larger capital and a wider knowledge of methods of feeding and handling, but under expert control are profitable and are capable of expansion. Suburban pig farming is, however, a business necessitating long hours and considerable labour and expense in collecting food, and unless conducted on specialised lines might readily become unprofitable or a mere "pot boiler"; thus it is often associated with the keeping of poultry as a side line.

Stud pig breeding requires special knowledge and the application of business principles even more so than any other branch of the industry, for unless the stud pig specialist is a business man or woman, and conducts the business on strictly business lines, it is unlikely as such to be successful. The cash capital required depends entirely upon the scope of operations, though stud pig breeding has its limitations, and is ordinarily more profitable when carried out in conjunction with one of the other systems referred to. There is plenty of scope for enthusiastic and capable farmers to further develop this class of stock raising, and the success of those primarily engaged in the business should be an incentive to others. The stud pig breeder needs to co-operate and advertise just as the commercial pig man must organise, and while the former must rank as a member of the Australian Stud Pig Breeders' Society, the latter should not overlook the importance of those organisations at work in the interests of the industry as a whole.

This list of systems of pig raising would not be complete without reference to the many enthusiastic and progressive members of Senior and Junior Pig Clubs, whose operations, while conducted on a limited scale, are, nevertheless, of importance to the industry. As members of the Stud Pig Breeders' Society increase in number, and there is a wider distribution of purebred stock, so also will there be increased interest among the juniors, many of whom will eventually become farmers, following up their project, and becoming the owners of more better-quality pigs and other stock.

Piggery Management.

It is again emphasised that the most progressive pig farmers in Queensland are those who practise and aim at efficiency and whose farms and piggeries are models of cleanliness and well-thought-out method.

Efficient management is an important factor in the success of every undertaking; hence as pig raising is a business venture it must be conducted efficiently to be profitable and worth while.

Nominally, the farmer must have as complete a practical and a theoretical knowledge of the business of pig raising as is possible. It is noticeable, nevertheless, that many farmers who have had little or no schooling in other than the practical side of the business are very often the most successful, for without doubt they have an inborn knowledge of the job.

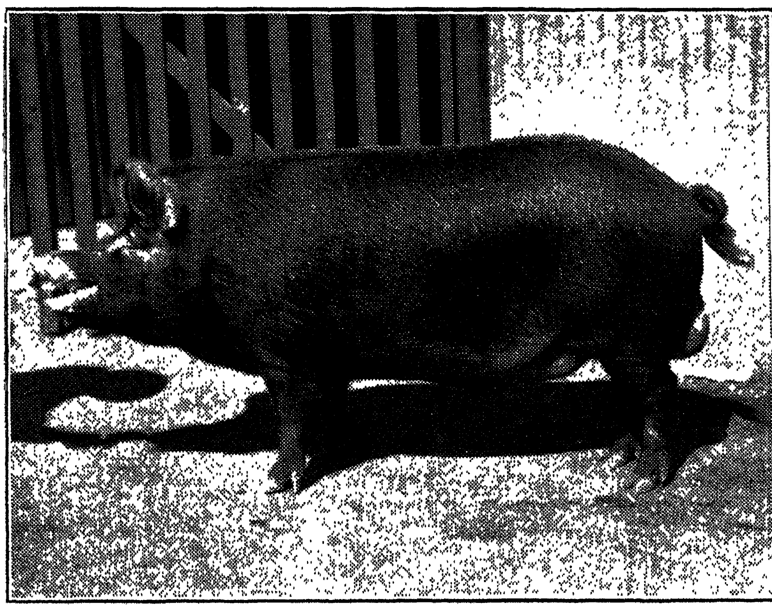


PLATE 37.

A. N. White's Champion Tamworth Boar, Sydney Show, 1934. This boar, Blakeney Tom, carries blood of strains that have been successful over a long period of years.

When pig raising is combined with dairying, it will be found as a workable rule that one breeding sow to every ten cows in milk will suffice. In other systems one sow per acre of good cultivation land will be about the correct proportion, with one boar to every fifteen sows kept. If accomomodation, capital, and additional food supplies are available, or if other phases of pig raising are also catered for, it may be possible to increase the number of pigs kept; actually it is better to have food to spare than to lose money by having more pigs than can be comfortably fed and profitably reared.

Experience proves that the Queensland farmer milking sixty cows comfortably handles six sows and one boar together with young pigs, provided some additional food is grown or purchased to supplement the

milk. Breeding stock should not be used for stud purposes until they are approximately ten months of age. After that, if they are carefully handled and kept in reasonable breeding condition, both boars and sows should be productive up to the age of six years or, perhaps, a year or two more. Some authorities prefer and suggest culling all breeders after they pass the age of three or four years.

Whatever happens, correct feeding and management are essential. Pigs necessarily consume large quantities of nutritious food to enable them to develop and mature early, for as baconers to reach 170 lb. live weight in 170 days from birth (birth weight about 2 lb.), and with a ratio of approximately 3 to 4 or possibly 5 lb. of food (dry matter), plus water, to each pound of pork produced, the modern pig is, indeed, as it has been styled, a "pork-producing machine" which must be bred, fed, and properly controlled in order to prove profitable.

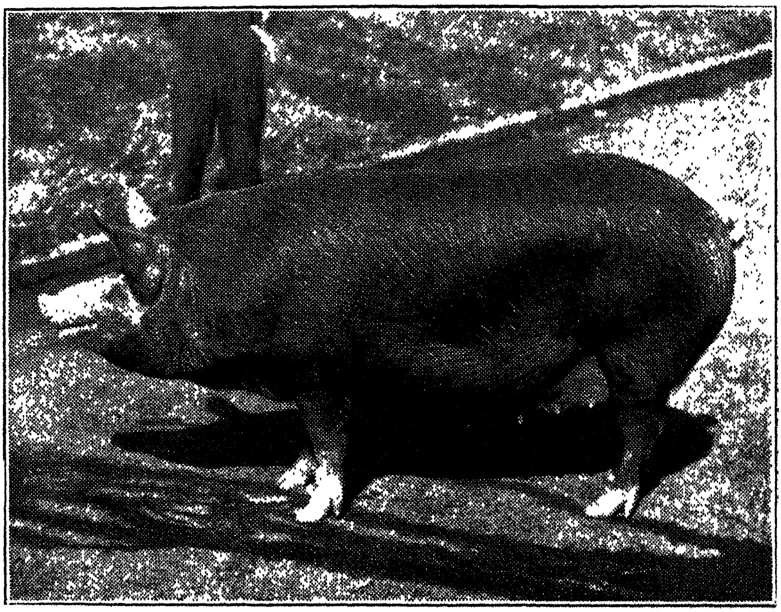


PLATE 38.

The Champion Tamworth Sow at the Sydney Show, 1934. The property of J. A. Murray. This sow, Kolodong Success, comes from noted prize-winning strains, and is herself a typical representative of the breed.

Good-quality breeding sows are procurable in Queensland at from £4 4s. at twelve to sixteen weeks of age to about £12 12s. each or so as sows ready for service or in-pig sows. Pedigreed boars are available at from £4 14s. 6d. at three months old to £12 12s. or so as yearlings ready for immediate use.

It has been remarked that in stock raising "half the breeding is in the feeding." It might be stated as equally true that in pig breeding it is impossible to expect good results from feeding inferior quality, slow-growing strains of pigs. A good sow mated to a superior quality boar will produce pigs worth twice as much as those produced by mongrel stock, while cost of production is lower in the former than in the latter. It is not to be expected that pigs will grow rapidly and

produce profitable returns unless improved breeding and selection go hand in hand with correct feeding and management.

Fortunately, fewer farmers keep unprofitable pigs now than formerly. Nevertheless, the pig industry still suffers considerable economic loss each year through the retention on farms of unsatisfactory breeding sows—i.e., sows only producing one litter of less than eight pigs per year instead of two of more than eight each—and also through the use of crossbred, mongrel, lazy, and unproductive boars.

The business of the pig farmer is, and always must be, to help the pigs in their progress from birth to factory, and to feed, handle, and market them in the most attractive and desirable form.

To be profitable, breeding sows should produce two litters per year of no fewer than eight and preferably ten or twelve pigs per litter. There are many sows producing litters of from ten to fourteen, and as it is possible to procure such sows as these it is not an economic proposition to be content with sows that regularly produce six to eight pigs per litter only. We must revise our ideas on these matters and realise that the breeding of productive pigs is a science and an art and not a common unbusinesslike farmyard practice. Unfortunately, too many farmers still depend almost entirely on the purchase of store pigs, and for these, at times, abnormally high prices are paid, and the margin of profit in finishing them for slaughter is considerably reduced.

It is desired to stress more dependence on breeding the pigs on the farm and not so much dependence on purchasing, although if properly conducted there is good profit for both parties in a well-conducted store pig business. The purchase of store pigs at high prices for sale later as baconers at an uncertain value is not usually in the best interests of either party, nor are the risks involved to be recommended.

For the purposes of marketing organisation, co-operative and proprietary bacon factories, meat export works, butchering and trading establishments generally have their place, and much success has attended their efforts. In fact, it is often remarked that if and when the farmer is as efficient at his job as the tradesman, the bacon curer, the smallgoodsman, and the factory manager, this industry will be regarded as the safest of all agricultural ventures and not the least profitable. There is, of course, much in the way of improvement that can and must be effected at the production end, but attention to marketing requirements by individual pig raisers is actually the first step in effective marketing organisation. In this connection, as in every other phase of the industry, the helping hand of Departmental officers is available on request, and every assistance is gladly and willingly rendered.

Poultry in the Orchard.

By P. RUMBALL, Poultry Expert.

THAT poultry raising and fruitgrowing can be combined profitably has already been proved in different parts of the State. With the fowls, the natural conditions in the orchard in the form of range, food, and shade make for good health in the flock; while the birds in turn benefit the fruit trees by keeping down weeds and insect pests, besides contributing a modicum of fertilizer to the soil.

Benefit of Fowls in the Orchard.

In the illustrations used in this article the absence of weed growth in the orchard will be noticed. This is not due to intense cultivation that is generally necessary, but to the presence of poultry. The owners of the farms where these pictures were taken assured the writer that before they kept fowls they were constantly cultivating and that now cultivation is only practised to loosen up the soil for the conservation of moisture. The keeping in check of weed growth means much to the orchardist, while to the fowls it serves as an article of diet which is highly necessary for the maintenance of good health.

Insect Pests.

The fruitgrower knows probably better than I do the large numbers of insect pests which are detrimental to his industry, and that many of them, such as pupæ of the fruit fly, &c., hibernate in the soil. Caterpillars, grasshoppers, crickets, and beetles of many descriptions, which cause damage to fruit and trees, fall easy victims to poultry, while the fowls' habits of dust bathing themselves in the shade of the trees tends to keep the soil loose and prevents the undue growth of surface roots.

Manurial Value.

Another advantage in keeping fowls in conjunction with fruitgrowing is that the manure is distributed throughout the orchard. The grower knows what it costs to manure per acre or what it should cost, but he does not always recognise the value of fowl manure. The quantity voided varies to some extent, of course, with different types of fowls and the method of feeding.

From a report published in the Journal of the Ministry of Agriculture of Great Britain of data collected at the College Poultry Farm, Theale, Reading, the following figures are taken:—

QUANTITIES VOIDED BY DIFFERENT BIRDS.

Kind of Fowl.	Weight.		Manure Voided Weekly.		Percentage of Body Weight.	Manure Voided per Bird per Annum (Fresh).	Number of Birds to Void One Ton per Annum (Fresh).
	Lb.	oz.	Lb.	oz.		Lb.	
Wyandotte cock ..	6	12	1	13	26·8	94¼	24
Faverolle hen ..	5	12	1	11¼	29·6	88½	25
Growing chicken, 14 weeks	3	12	1	2½	30·8	..	..

The breeds principally used for egg production in Queensland are not shown, but it will be seen that the laying hen and the growing chicken void a greater percentage than an adult male bird, and with high-producing birds, such as the Leghorn and Orpington, a conservative estimate would be 30 per cent. of live weight voided weekly; therefore, a 4-lb. Leghorn would void per annum 62¼ lb. and a 5-lb. Australorp 78, while it would take thirty-seven Leghorns or twenty-nine Australorps to void a ton.

Composition of Fresh Poultry Manure.

The analysis of poultry manure varies with feeding, but that from stock fed on lines usually adopted for the maximum production should comply very closely to the following:—

Moisture.	Dry matter.	Nitrogen,	Phosphoric acid.	Potash.
59·50	40·50	1·47	·71	·49

The commercial value of this manure based on its unit value is from 20s. to 35s. per ton, and the running of 200 fowls or slightly less per acre would be the means of manuring the land to the value of £5 to £7 10s. However, its principal property being nitrogen some will be lost owing to its volatile nature, but there is in addition to the principal concentrates the organic matter—material which is an improvement to all soils.

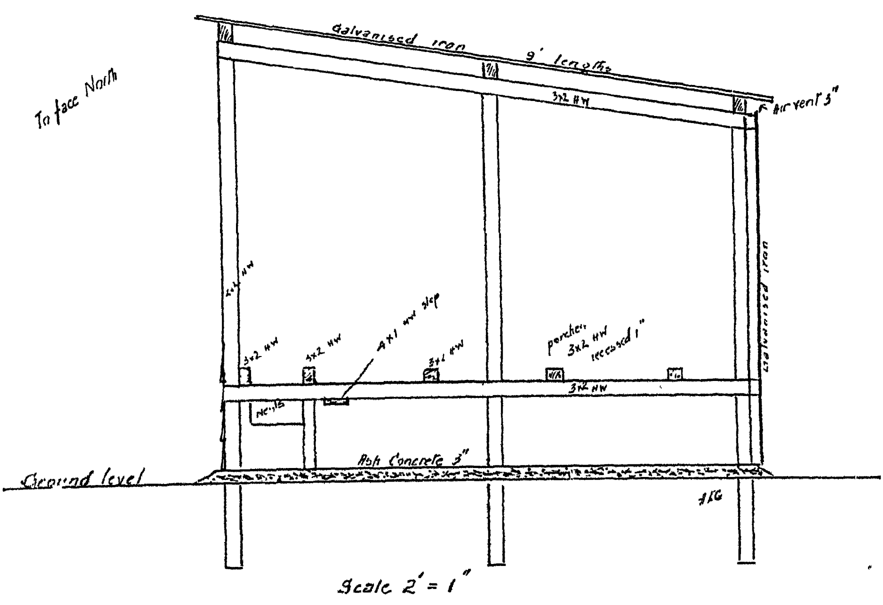


PLATE 39 (Fig. 1).

Additional financial returns will depend largely upon the class of stock kept and the attention bestowed on them. Although they will save the grower many days' labour in cultivation, spraying, &c., they will demand daily attention, and to the producer who is not inclined to give them this attention they are not recommended. Only the best should be kept. The breeding, rearing, and feeding should receive the same attention as the poultry farmer devotes to this work, as it is only by these

means that the maximum results will be obtained. Generally speaking, each hen should return a profit over cost of feed, when kept in the vicinity of Brisbane, of about 5s., and 150 to 200 could be run per acre. This, in conjunction with the usefulness of the birds as pest destroyers and the manurial value of their voidings, should prove an incentive to fruitgrowers to work along these lines.

Making a Start.

Although the foregoing may appear attractive, in making a start. caution should be observed. The work of keeping poultry has to be fitted in and the great majority have to gain the experience essential for the rearing of young stock and the feeding of layers. A start should be made by the erection of a poultry house on the lines outlined in the plans, figs. 1, 2, and 3. This house can be used with the addition of a brooder. After the brooding stage it can be used as a rearing house, and ultimately serve its original purpose of housing the adult laying stock. The rearing of chickens in quarters used for adult stock is not usually recommended, but under the conditions of range in the orchard soil contamination does not occur to any great extent.

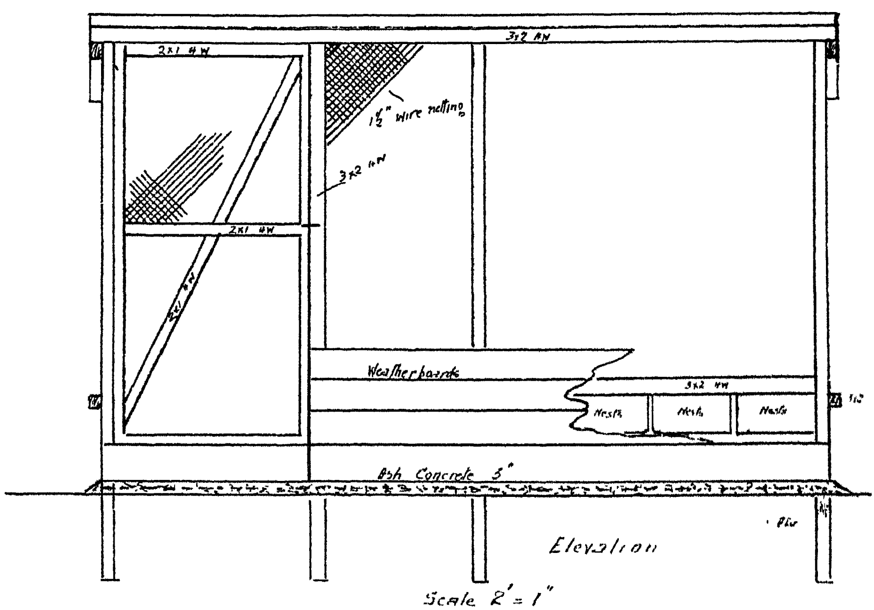
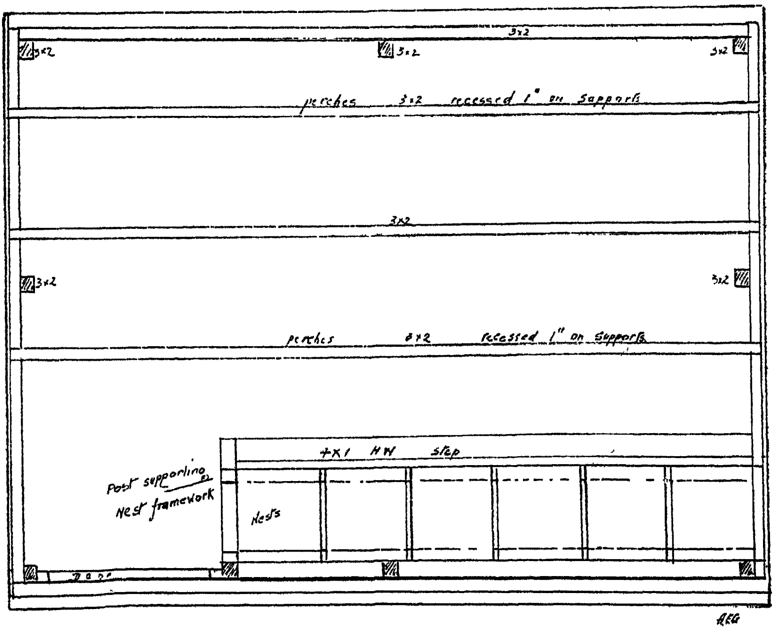


PLATE 40 (Fig. 2).

The purchase of day-old chickens should then be made from some reputable breeder, and so save the necessity of buying breeding stock and the work entailed in incubation. By doing this the number of chickens you have for a start are definite, they will be of the same age, which facilitates rearing and prevents the period of rearing being unduly prolonged and becoming irksome. In making the purchase, be sure and go

to a reputable breeder who maintains the qualities of both numbers and size of eggs in his stock.

Possibly the best months for securing chickens is during August and September. Earlier chickens can be made use of if it is desired to have two lots during the one season, and so allow the first lot to get off your hands before a second lot is commenced with, say, in September.



Ground Plan

Scale 2' = 1"

PLATE 41 (Fig. 3).

Netting partitions to keep various ages separate may be erected at convenient spaces if desired, but they interfere with the cultivation of the orchard and are not absolutely essential. If chickens are reared in a special house and confined for two or three weeks within a temporary fence they will invariably return to their own quarters to camp. Larger houses than shown in the plan may be built, but units of fifty placed at intervals about the orchard will ensure a better distribution of the birds' droppings and incidentally will cause the birds to forage over the whole of the orchard.

The system of feeding adopted may be either wet mash in the morning and grain at night, or dry mash in hoppers, which is before the birds all day, and grain at night or all mash. The latter system, especially to the novice and to the grower who desires to reduce his work is recommended. The birds by this means are assured of getting all the food they require for egg production, while the grower is relieved of much work daily.

PLATE 42 (Fig. 4).—PAPAWS AND POULTRY.

The luxuriant growth here seen is, to a very large extent, undoubtedly due to the fertilizing value of the poultry manure. The soil is of a light loamy nature, and not naturally rich in plant food.

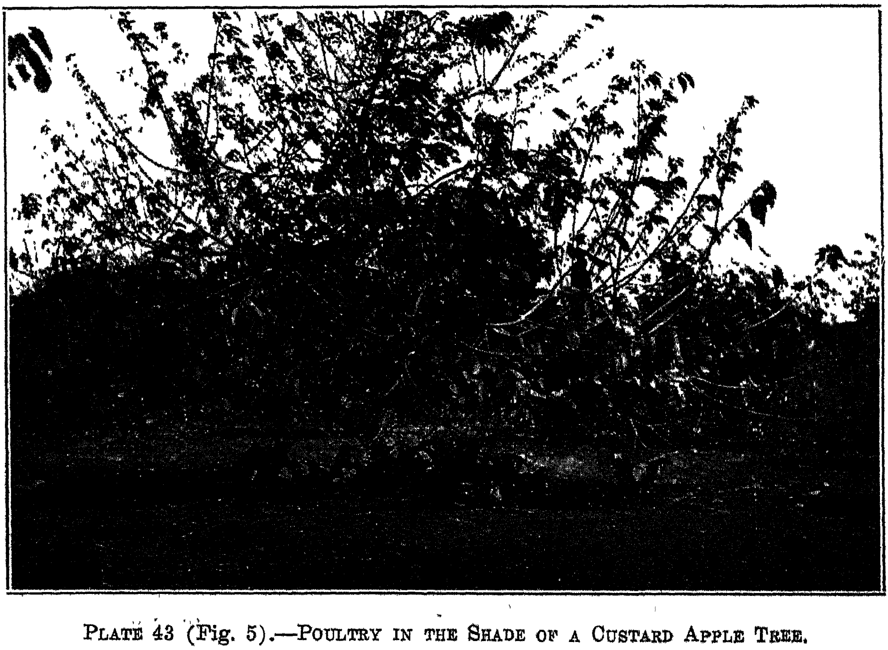


PLATE 43 (Fig. 5).—POULTRY IN THE SHADE OF A CUSTARD APPLE TREE.

This class of fruit tree offers a maximum amount of shade to poultry in summer.

Reference to the plan, figs. 1, 2, and 3, plainly indicate the simple nature of the house suggested for the purpose of housing fifty laying hens. It is simple in structure, being open fronted, roofed, and walled at back and ends with corrugated iron. A 3-inch open space is provided between the top of the back wall and roof to permit of a good circulation of air. In front weather boards are used as a shield to the nests, the balance being netted in to allow of the stock being protected from predatory animals during the night. The nests are made from petrol tins, one side of which, with the exception of 1¼ inch, is removed. This is then turned at right angles to prevent the tin falling through the nest framework. Three perches are shown, 3 by 2 hardwood being used. This is placed on edge and the top corners slightly champered. They are supported on the bottom batten, and by being recessed to the depth of an inch are perfectly firm, and at the same time are easily removed for cleaning purposes.

PLATE 44 (Fig. 6).

Citrus fruit growing and poultry keeping is commonly practised in different localities. The benefits to this particular farmer of the combination have been less work and greater returns.

The floor is raised to the extent of 3 inches above ground level to ensure dryness. Concrete is recommended, being readily cleaned and it does not become saturated with droppings. Earthen floors become foul and require renewal at frequent intervals.

The lines suggested on which a start should be made are economical as regards permanent fixtures and equipment, and also relieve the producer for the time being of establishing breeding pens, the necessity of purchasing incubators, and becoming acquainted with the operations of an incubator.

For further information on feeding obtain the Departmental leaflet on this subject.

Marketing Oranges at Home and Abroad.

By JAS. H. GREGORY, Instructor in Fruit Packing.

(*Continued from page* 666, Vol. XLI., Part 6—June.)

PART II.

Packing the Standard Box.

THE Standard Box (18 inches long by 11½ inches wide by 10½ inches deep) is very easy to pack when made correctly. The timber for this box should be milled so that the sides of the box are cut to a minimum thickness of five-sixteenths of an inch. The bottoms and tops should be cut three-sixteenths of an inch thick to allow a bulge to be placed on the finished case without injuring the fruit. This thin timber is prevented from splitting by cleats nailed across the ends of the boards, driving the nails through both the cleat and the bottom and top whilst making and lidding the case. The Standard Case should have a bulge in the centre of 1 inch to 1½ inches on the top and bottom of the case when packed and lidded.

Table "C."

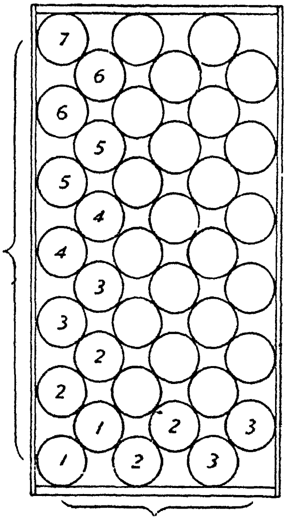
A simplified table of packs to use when packing the Standard Box is as follows:—These packs will give the correct bulge on the top and bottom of the case when the timber for the tops and bottoms is cut to the correct thickness of three-sixteenths of an inch:—

Approximate Size.	Pack.	Layer Count.	Number of Layers.	Total.
2¼ inches	3-3	7-7	6	252
	3-3	7-6	6	234
	3-3	6-6	6	216
	3-3	6-5	6	198
2½ inches	3-3	5-5	6	180
	3-2	7-7	5	175
	3-2	7-6	5	163
2¾ inches	3-2	6-6	5	150
	3-2	6-5	5	138
	3-2	5-5	5	125
3 inches	3-2	5-4	5	113
	3-2	4-4	5	100
3¼ inches	2-2	6-6	4	96
	2-2	6-5	4	88
	2-2	5.5	4	80
3½ inches	2-2	5-4	4	72
	2-2	4-4	4	64
3¾ inches	2-2	4-3	4	56
	2-2	3-3	4	48

It is preferable to use a 3–2 pack instead of a 3–3, as the 3–2 pack will have smaller pockets, and will look better when opened. The same rule applies in using a 2–2 pack instead of a 3–2, when the same fruit can be packed both ways.

HOW TO READ AND USE THE PACKING TABLE.

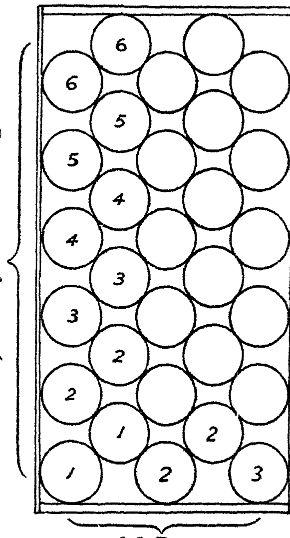
The Layer Count is obtained by counting in the first layer two alternate lines of fruit from end to end in the case, this layer count being 7 x 6.



3-3 PACK.

The Pack gets its name from the way the first six fruit are placed in the layer. The Count is made of the first two lines of fruit across the case.

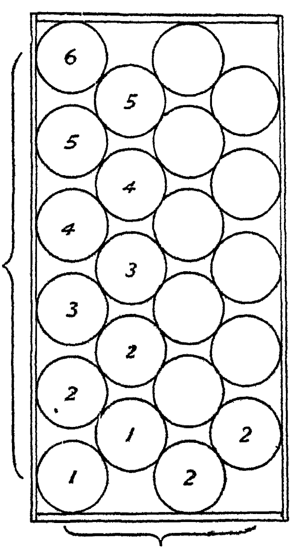
The Layer Count is obtained by counting in the first layer two alternate lines of fruit from end to end in the case, this layer count being 6 x 6.



3-2 PACK.

The Pack gets its name from the way the first five fruit are placed in the layer. The Count is made of the first two lines of fruit across the case.

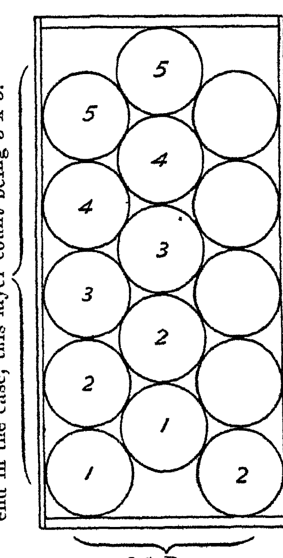
The Layer Count is obtained by counting in the first layer two alternate lines of fruit from end to end in the case, this layer count being 6 x 5.



2-2 PACK.

The Pack gets its name from the way the first four fruit are placed in the layer. The Count is made of the first two lines of fruit across the case.

The Layer Count is obtained by counting in the first layer two alternate lines of fruit from end to end in the case, this layer count being 5 x 5.



2-1 PACK.

The Pack gets its name from the way the first three fruit are placed in the layer. The Count is made of the first two lines of fruit across the case.

PLATE 45.

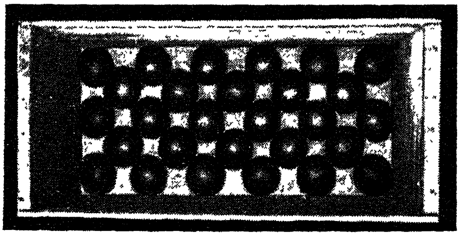
AUSTRALIAN DUMP CASE.

TABLE A.

First Layer.

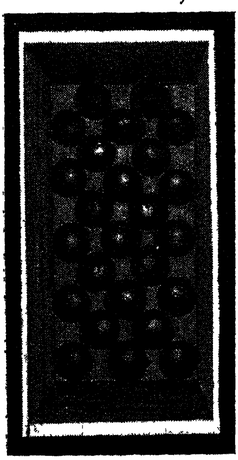
3-2 Pack, 6 x 5 Layer Count, 8 Layers: total, 220 Oranges.

Bottom.

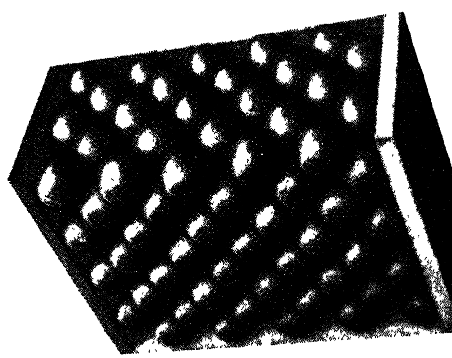


Top.

3-2 Pack, 5 x 5 Layer Count, 8 Layers: total, 200 Oranges.

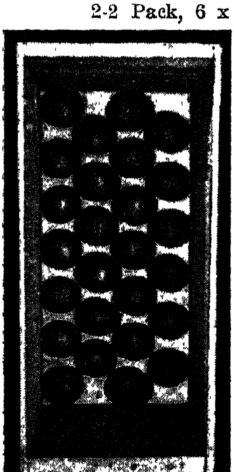


First Layer.

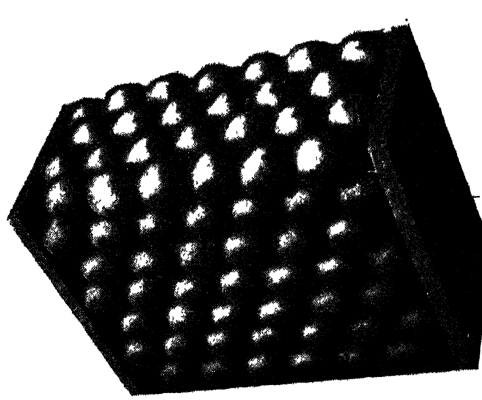


Finished Case. 200 Count.

2-2 Pack, 6 x 5 Layer Count, 7 Layers: total, 182 Oranges.



First Layer.



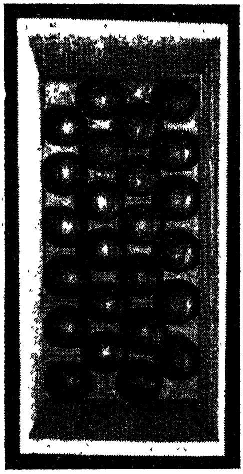
Finished Case. 182 Count.

2-2 Pack, 7 x 6 Layer Count, 7 Layers: total, 182 Oranges.

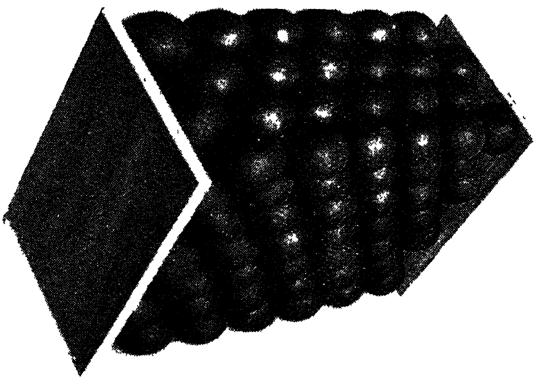
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-2 Pack, 6 x 6 Layer Count, 7 Layers: total, 168 Oranges.

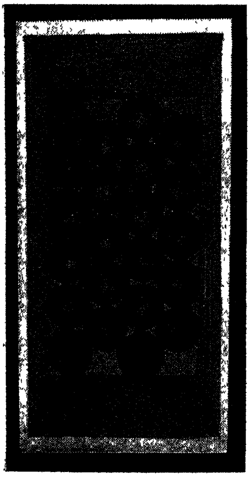


First Layer.

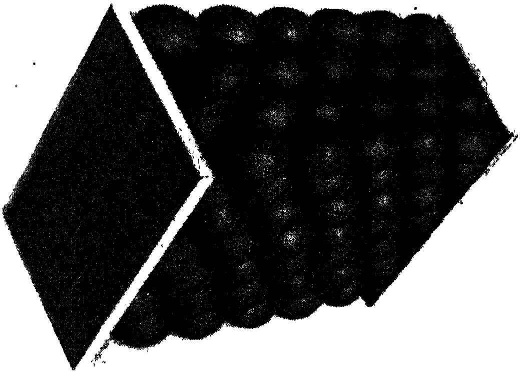


Finished Case. 168 Count.

2-2 Pack, 6 x 5 Layer Count, 7 Layers: total, 154 Oranges.



First Layer.



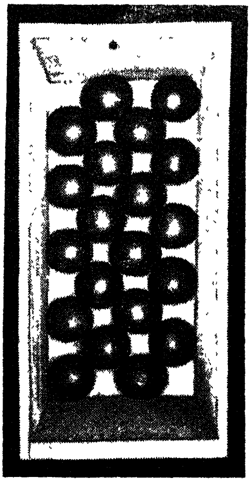
Finished Case. 154 Count.

PLATE 47.

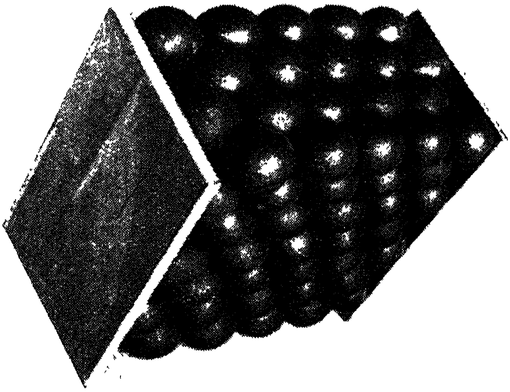
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-2 Pack, 5 x 5 Layer Count, 7 Layers: total, 140 Oranges.

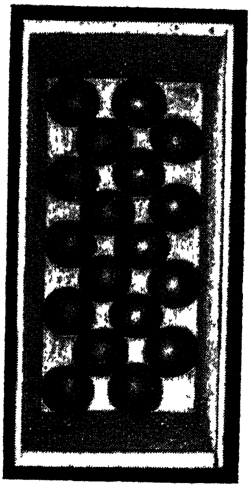


First Layer.

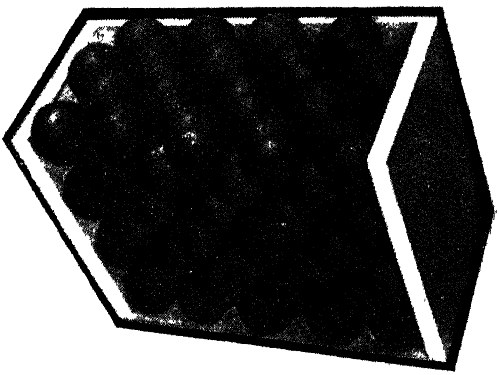


Finished Case. 140 Count.

2-2 Pack, 5 x 4 Layer Count, 7 Layers; total, 126 Oranges.



First Layer.



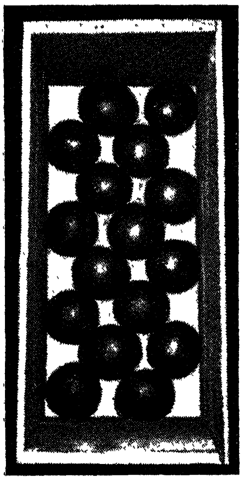
Finished Case. 126 Count.

PLATE 48.

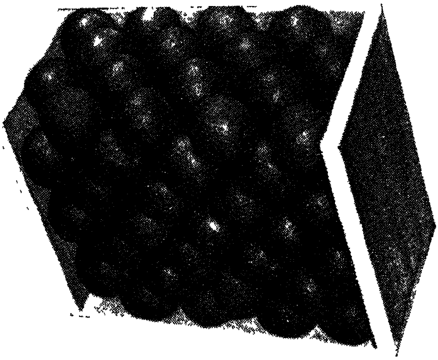
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-2 Pack, 4 x 4 Layer Count, 7 Layers: total, 112 Oranges.

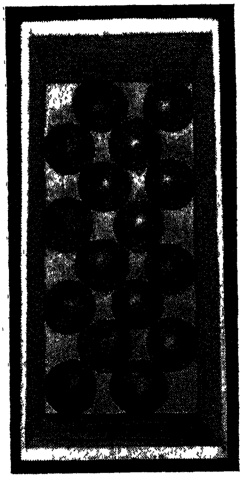


First Layer.
See note on 96 Count.

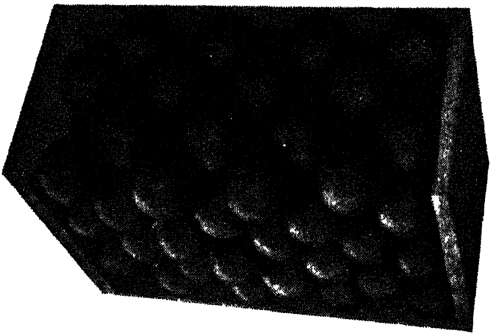


Finished Case. 112 Count.

2-2 Pack, 4 x 4 Layer Count, 6 Layers: total, 96 Oranges.



First Layer.



Finished Case. 96 Count.

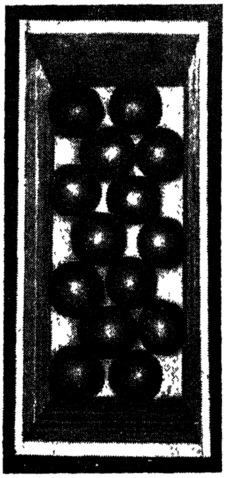
NOTE.—The same number of fruit is contained in each layer of both 96 and 112 Counts, the difference in the packed case being the number of layers—96 containing 6, 112 containing 7.

PLATE 49.

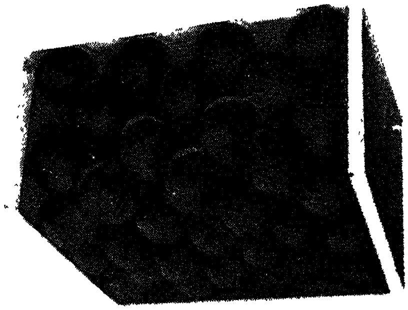
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-2 Pack, 4 x 3 Layer Count, 6 Layers: total, 84 Oranges.

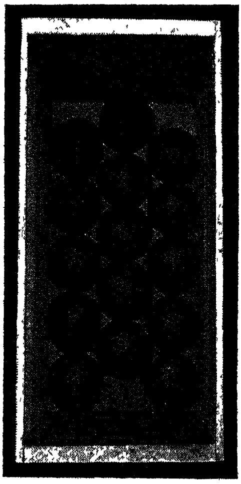


First Layer.

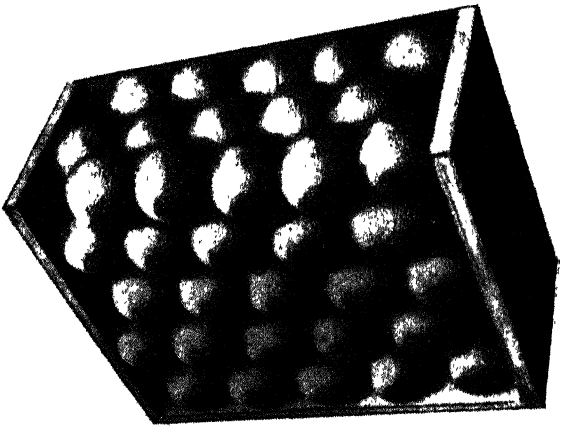


Finished Case. 84 Count.

2-1 Pack, 5 x 5 Layer Count, 5 Layers: total, 75 Oranges.



First Layer.



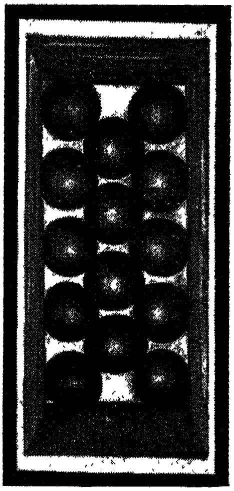
Finished Case. 75 Count.

PLATE 50.

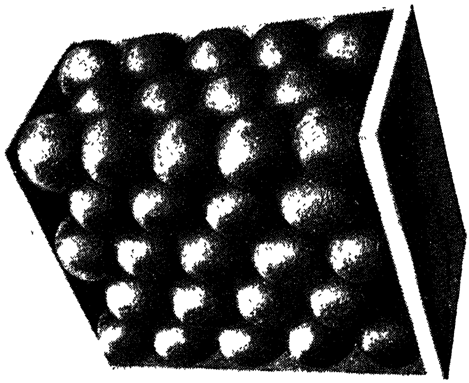
AUSTRALIAN DUMP CASE—*continued.*

TABLE A.—*continued.*

2-1 Pack, 5 x 4 Layer Count, 5 Layers: total, 68 Oranges.

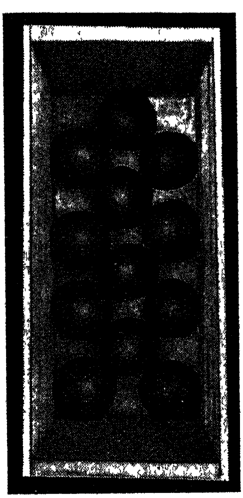


First Layer.

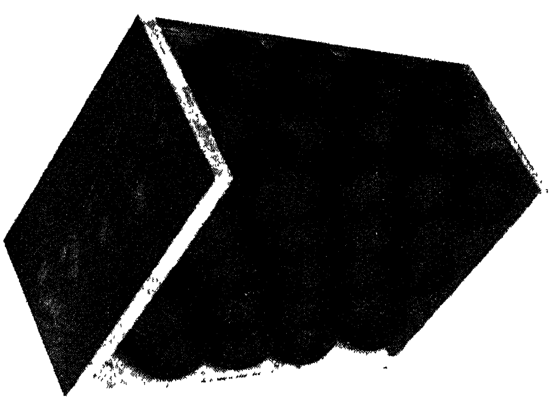


Finished Case. 68 Count.

2-1 Pack, 4 x 4 Layer Count, 5 Layers: total, 60 Oranges.



First Layer.



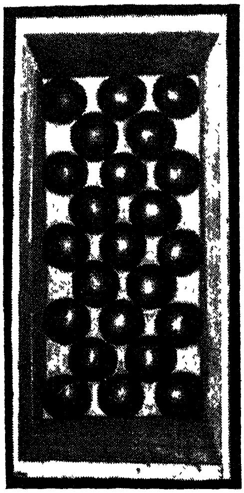
Finished Case. 60 Count.

PLATE 51.

AUSTRALIAN DUMP CASE—*continued.*

TABLE B.

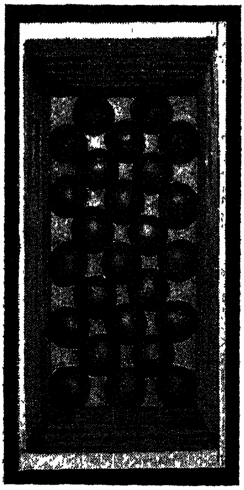
3-2 Pack, 5 x 4 Layer Count, 8 Layers: total, 180 Oranges.



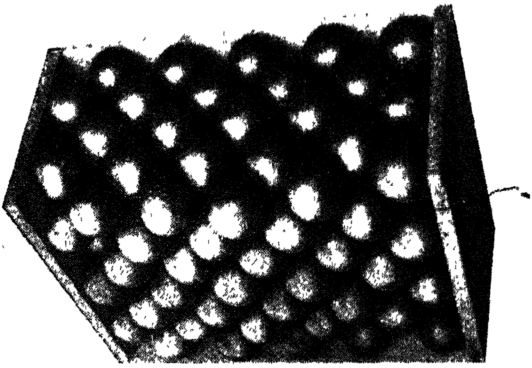
First Layer.

NOTE.—The same Layer Count (3-2, 5 x 4) is used when packing 158 Pack, which contains one layer less.

3-2 Pack, 5 x 5 Layer Count, 7 Layers: total, 175 Oranges.



First Layer.



Finished Case. 175 Count.

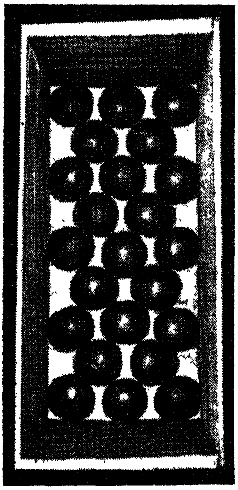
NOTE.—The same Layer Count (3-2, 5 x 5) is used when packing 200-pack, which contains 8 layers.

PLATE 52.

AUSTRALIAN DUMP CASE—*continued.*

TABLE B—*continued.*

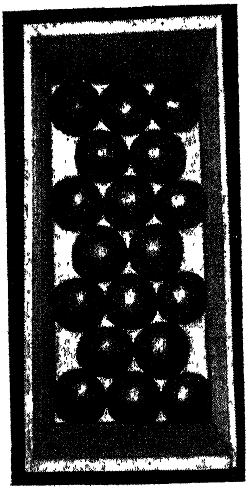
3-2 Pack, 5 x 4 Layer Count, 7 Layers, total, 158 Oranges.



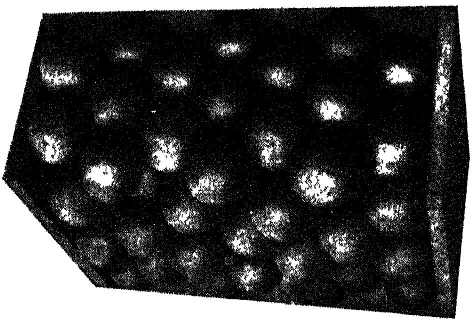
First Layer.

NOTE.—The same Layer Count (3-2, 5 x 4) is used when packing the 180 Pack, which contains one layer more.

3-2 Pack, 4 x 3 Layer Count, 6 Layers: total, 105 Oranges.



First Layer.



Finished Case.

PLATE 53.

Table "D."

Intermediate Packs for the Standard Case.—Avoid using these packs as much as possible. Use them only for types of fruit that do not come to the correct height when the packs mentioned in Table "C" are used:—

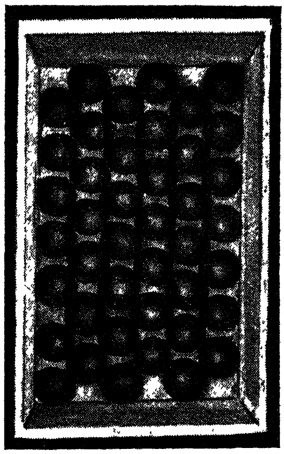
Approximate Size.	Pack.	Layer Count.	Number of Layers.	Total.
2¼ inches	3-3	8-7	5	225
	3-3	7-7	5	210
	3-2	8-8	5	200
	3-3	7-6	5	195
2½ inches	3-2	8-7	5	188
	3-3	6-6	5	180
	3-3	6-5	5	165
	3-3	5-4	6	162
	3-3	5-5	5	150
2¾ inches	3-3	5-4	5	135
	3-3	4-4	5	120
	3-2	6-6	4	120
3 inches	3-2	6-5	4	110
	3-2	5-4	4	90
	3-2	4-3	5	88

Bringing the Pack to the Correct Height in the Case.—Oranges packed in the Standard Case should be packed 1½ to 2 inches above the top of the case, and be gently eased into position before applying the lid. This operation is done either by using a case press, or by placing blocks under the ends of the case and using a dumping lid, which is placed on the case and held in position whilst the ends of the case are gently bumped, the fruit settling gently into the pockets of each layer. When using the press or blocks for the process of dumping, care must be taken to see that the bottom of the case is kept clear of the floor or nailing-down stand, so that the bottom of the case can bulge when the nailing-down is complete. A good dumping lid is made by thinly padding a piece of wood the same size as the lid of the case with hessian or a similar substance. After nailing the Standard Case should have a bulge on the top and the bottom of from 1 inch to 1½ inches. Remember tight or closed packs, such as count 175, should not be brought as high in the case as the open or loose packs, such as count 180.

Where lids and bottoms are cut too thick for them to bend easily when being placed on the case, it is better for the packer to reduce the height of the fruit in the case to avoid squeezing or pressure marks. The advantages of using the correct bulge can easily be offset by badly-milled case lids and bottoms causing damage.

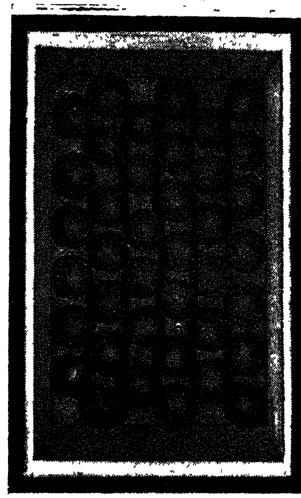
STANDARD CASE.

First Layer.
3-3 Pack.



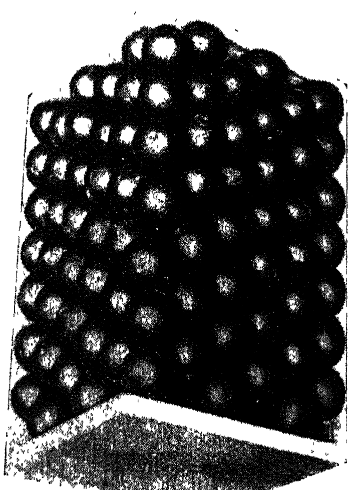
7 x 7 Layer Count, 6 Layers: total, 252.

First Layer.
3-3 Pack.



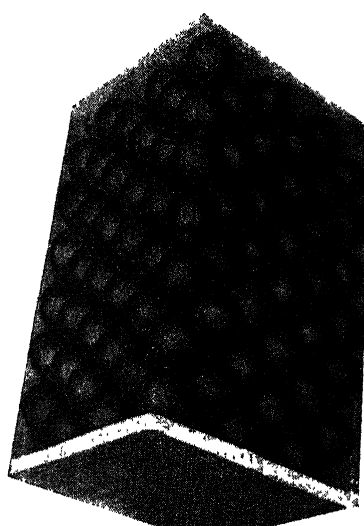
7 x 6 Layer Count, 6 Layers: total, 234.

Finished Case.



3-3 Pack, 252 Count.

Finished Case.



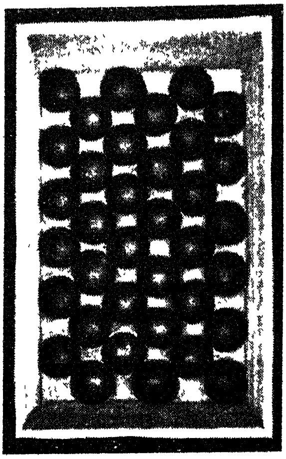
3-3 Pack, 234 Count.

Note the alignment of the fruit in the case.

PLATE 54.

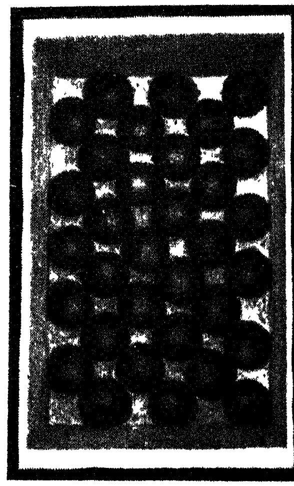
STANDARD CASE.

First Layer.
3-3 Pack.



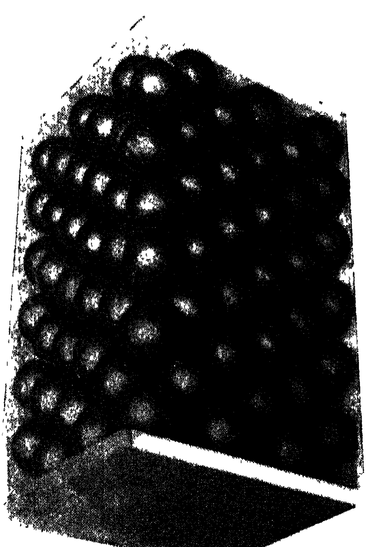
6 x 6 Layer Count, 6 Layers:
216 Count.

First Layer.
3-3 Pack.



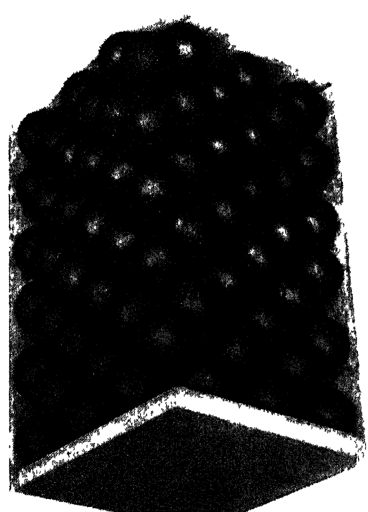
6 x 5 Layer Count, 6 Layers:
198 Count.

Finished Case.



3-3 Pack, 216 Count.

Finished Case.



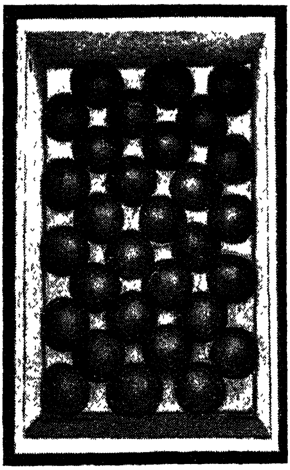
3-3 Pack, 198 Count.

Note the alignment of the fruit in the case.

PLATE 55.

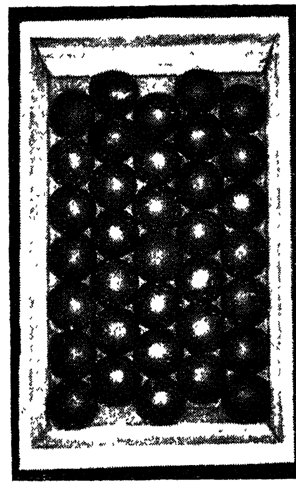
STANDARD CASE.

First Layer.
3-3 Pack.



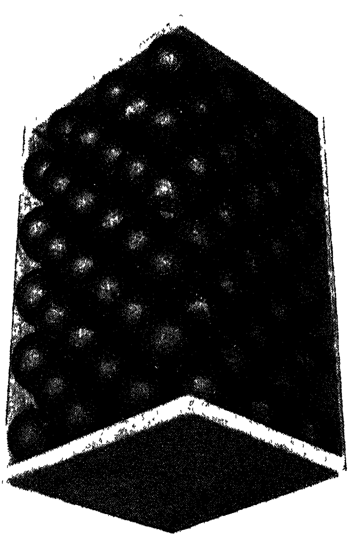
5 x 5 Layer Count, 6 Layers: total, 180.

First Layer.
3-2 Pack.



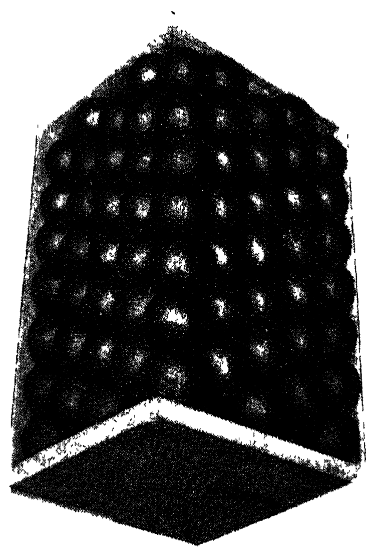
7 x 7 Layer Count, 5 Layers: total, 175.

Finished Case.



3-3 Pack, 180 Count.

Finished Case.



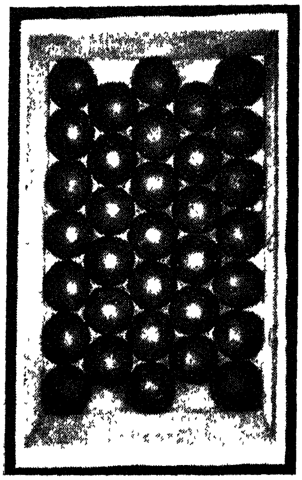
3-2 Pack, 175 Count.

Note the alignment of the fruit in the case.

PLATE 56.

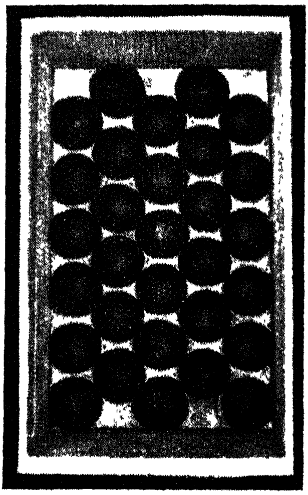
STANDARD CASE.

First Layer.
3-2 Pack.



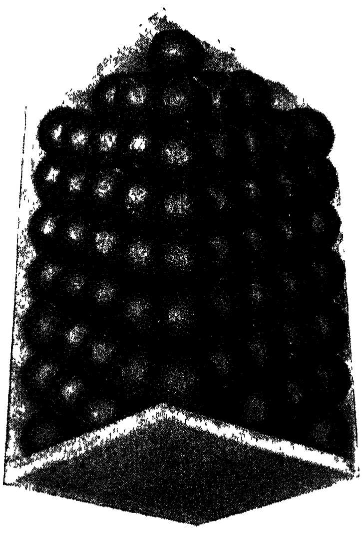
7 x 6 Layer Count, 5 Layers: total, 163.

First Layer.
3-2 Pack.



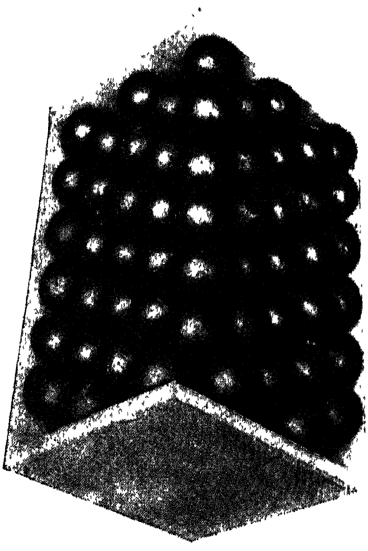
6 x 6 Layer Count, 5 Layers: total, 150.

Finished Case.



3-2 Pack, 163 Count.

Finished Case.



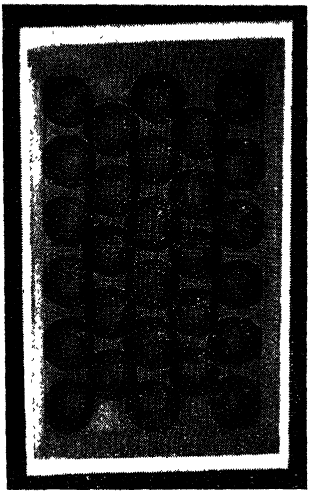
3-2 Pack, 150 Count.

Note the alignment of the fruit in the case.

PLATE 57.

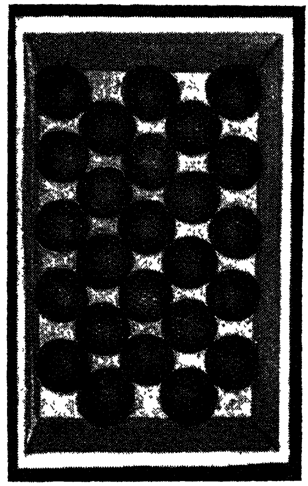
STANDARD CASE.

First Layer.
3-2 Pack.



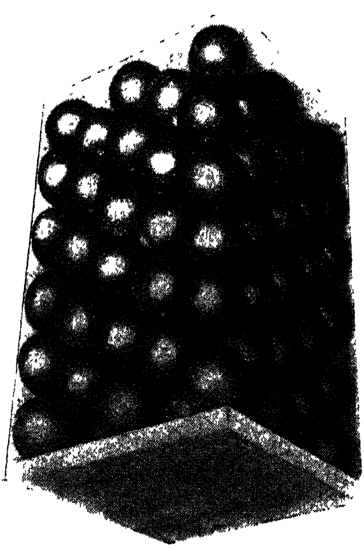
6 x 5 Layer Count, 5 Layers: total, 138.

First Layer.
3-2 Pack.



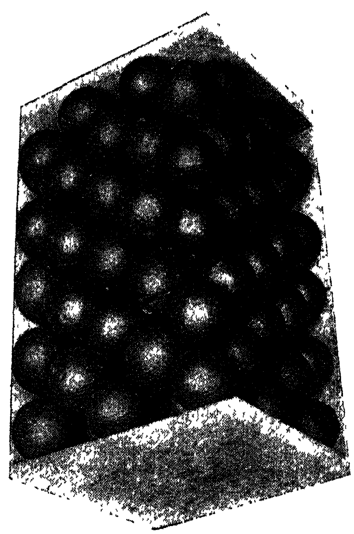
5 x 5 Layer Count, 5 Layers: total, 125.

Finished Case.



3-2 Pack, 138 Count.

Finished Case.



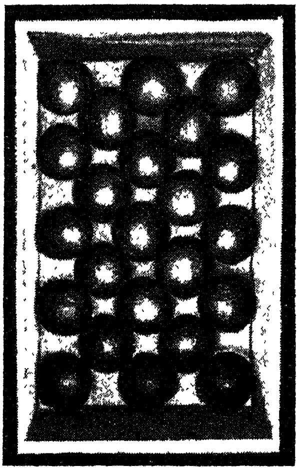
3-2 Pack, 125 Count.

Note the alignment of the fruit in the case.

PLATE 58.

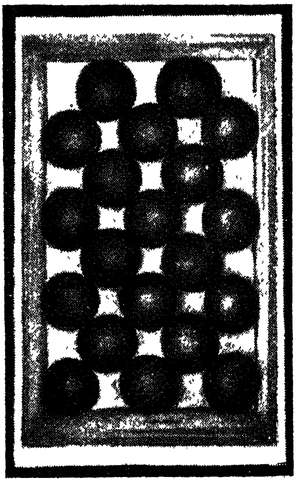
STANDARD CASE.

First Layer.
3-2 Pack.



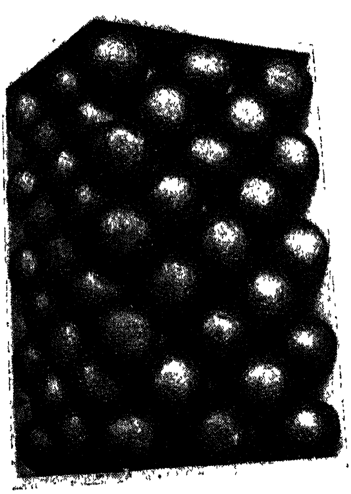
5 x 4 Layer Count, 5 Layers: total, 113.

First Layer.
3-2 Pack.



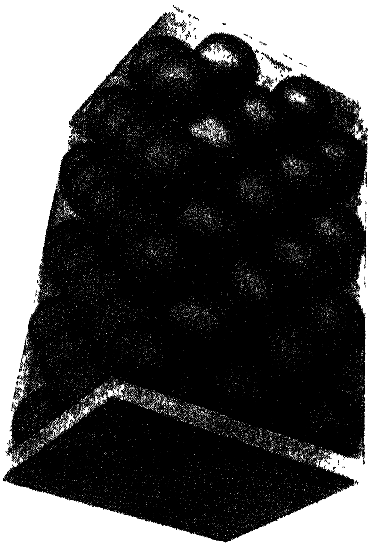
4 x 4 Layer Count, 5 Layers: total, 100.

Finished Case.



3-2 Pack, 113 Count.

Finished Case.



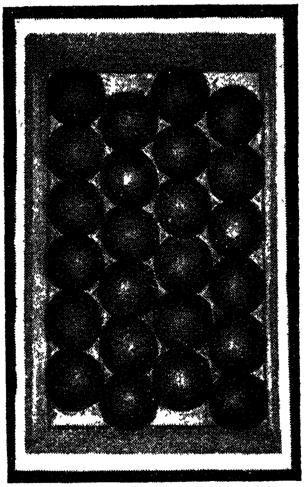
3-2 Pack, 100 Count.

Note the alignment of the fruit in the case.

PLATE 59.

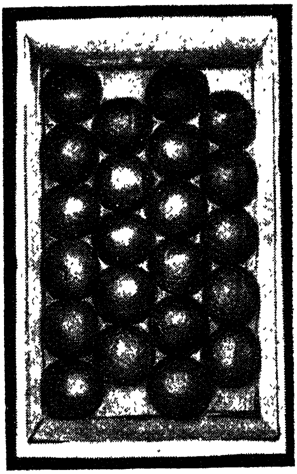
STANDARD CASE.

First Layer.
2-2 Pack.



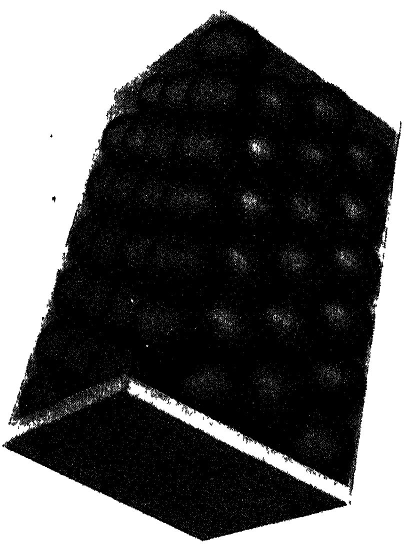
6 x 6 Layer, 4 Layers: total, 96.

First Layer.
2-2 Pack.



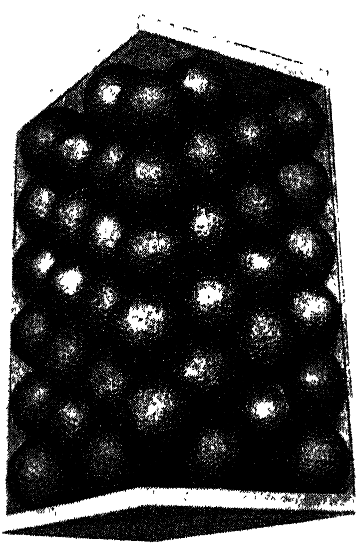
6 x 5 Layer, 4 Layers: total, 88.

Finished Case.



2-2 Pack, 96 Count.

Finished Case.



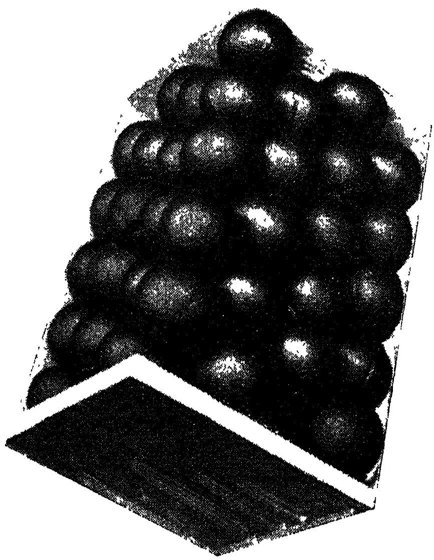
2-2 Pack, 88 Count.

Note the alignment of the fruit in the case.

PLATE 60.

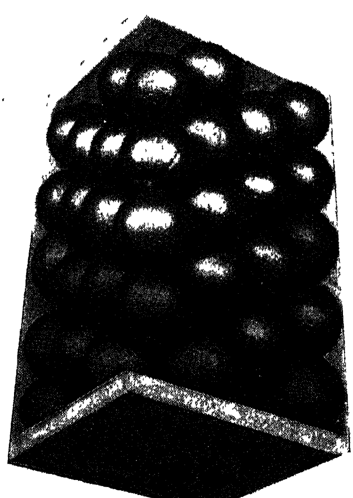
STANDARD CASE.

Finished Case.



2 2 Pack, 5 x 5 Layer. 4 Layers, 80 Count.

Finished Case.



2-2 Pack, 5 x 4 Layer. 4 Layers, 72 Count.

Note the alignment of the fruit in the case.

PLATE 61.

[TO BE CONTINUED.]

Casein as a Commercial Commodity.

THE manufacture of casein from skim milk and butter milk is an industry that has been carried on in other parts of the world for years. The importance of casein, particularly casein glue, was realised during the war, when it was used extensively in aeroplane construction, especially for plywood for fuselage coverings, and engine beds. Since the World War its manufacture has increased enormously owing to the increasing commercial application of this commodity.

It is difficult to keep pace with the march of casein into the commercial arena. It has entered the paper industry, where it is used for producing highly glossed surfaces on paper so essential for fine lithographic work. It is utilised extensively in glue preparations, supplanting many of the animal and other glues previously known. As a glue it is used in wood-working industries, such as motor-car body frames, pianos, furniture, doors, refrigerators, and numerous others.

In the realm of plastics its uses are increasing day by day, it being used as a substitute for horn, celluloid, bone, ivory, ebony, pearl, amber, and tortoise shell, and when we consider the vast number of beads, buttons, buckles, combs, cigarette holders, cuff links, electrical insulators, manicure and toilet sets, pen holders, fountain pen barrels, pencils, pipe stems, spectacle frames, &c., that are sold every day, some idea can be gleaned of the importance of casein in the plastic industry alone.

The articles already mentioned should suffice to establish its importance, but when we remember also that it is extensively used in such industries as paints, textiles, leathers, spreaders, and adhesives, foods, and medicine preparations, and such miscellaneous substances as face cream, pastes, shoe polish, insecticides, sprays, &c., so it is obvious that the possibilities of casein as a commercial commodity are enormous.

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It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Testing Acidity in Milk and Cream.

Material Required.

Decinormal caustic soda solution.

Phenol-phthalein solution (indicator).

(The above solutions should be prepared by a chemist.)

One pipette of 9, 10, or 17·6 c.c. or other stock size.

One white cup.

One 25 c.c. burette graduated to 0·1 c.c.

Distilled or rain water.

One glass stirring-rod.

Method of Making the Test.

1. First stir the cream or milk in order that a representative sample of the whole may be obtained.

2. Measure a sample of cream or milk into the cup. Rinse the pipette with distilled or rain water, and place the rinsings also in the cup.

3. Add three or four drops of indicator.

4. From the burette run the alkali solution into the mixture while constantly stirring it, and until it assumes a uniform faint pink tint. This is the end point of the test and all acid is neutralised.

Especial care should be taken at this point. If the colour does not disappear within thirty to sixty seconds after the completion of the test, too much alkali has been used, and an incorrect result will be obtained.

5. Note to 0·1 c.c. the quantity of alkali used.

Calculating the Result of the Test.

As 1 c.c. of the alkali solution exactly neutralises 0·009 grammes of lactic acid, the result may be obtained as follows:—

Multiply the number of c.c. of alkali used by 0·009, divide the result by the number of c.c. of the sample of cream or milk, and multiply this result by 100.

The method generally adopted in making this test in dairy factories in this State is similar to the above, but a 9 c.c. pipette is used, and the test result is read direct from the burette, each cubic c.c. of alkali used being calculated as 0·1 per cent. of acid; thus, if the amount of alkali used to neutralise 9 c.c. of milk or cream is 2·7 c.c., the acidity is 0·27 per cent.

This method is simple and quite satisfactory if care be taken to ensure accuracy in measuring the sample of milk or cream, the amount of alkali used, and in completing the test as indicated by the action of the

ACIDITY REDUCTION TABLE FOR CREAM.

Compiled by F. J. WATSON, Dairy Instructor.

Basis of Table:—·093 lb. soda bicarb. neutralises ·1 per cent. of acid in 100 lb. cream.

PERCENTAGE OF REDUCTION DESIRED.

BICARBONATE OF SODA REQUIRED IN POUNDS AND OUNCES.

..	·02	·04	·06	·08	·10	·12	·14	·16	·18	·20	·22	·24	·26	·28	·30	·32	·34	·36	·38	·40	·42	·44	..
lb. cream.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. cream.
50	0 0	0 0	0 0	0 0	0 0	0 1	0 1	0 1	0 1	0 1	0 2	0 2	0 2	0 2	0 2	0 2	0 2	0 3	0 3	0 3	0 3	0 3	50
100	0 0	0 0	0 1	0 1	0 1	0 2	0 2	0 2	0 3	0 3	0 3	0 4	0 4	0 4	0 4	0 5	0 5	0 5	0 6	0 6	0 6	0 7	100
200	0 0	0 1	0 2	0 2	0 3	0 4	0 4	0 5	0 6	0 6	0 7	0 7	0 8	0 8	0 9	0 10	0 10	0 11	0 11	0 12	0 12	0 13	200
300	0 1	0 2	0 3	0 4	0 4	0 5	0 6	0 7	0 8	0 9	0 10	0 11	0 12	0 13	0 13	0 14	0 15	1 0	1 1	1 2	1 3	1 4	300
400	0 1	0 2	0 4	0 5	0 6	0 7	0 8	0 10	0 11	0 12	0 13	0 14	0 15	1 1	1 2	1 3	1 4	1 5	1 7	1 8	1 9	1 10	400
500	0 1	0 3	0 4	0 6	0 7	0 9	0 10	0 12	0 13	0 15	1 0	1 2	1 3	1 5	1 6	1 8	1 9	1 11	1 12	1 14	1 15	2 1	500
600	0 2	0 4	0 5	0 7	0 9	0 11	0 12	0 14	1 0	1 2	1 4	1 5	1 7	1 9	1 11	1 13	1 14	2 0	2 2	2 4	2 5	2 7	600
700	0 2	0 4	0 6	0 8	0 10	0 12	0 15	1 1	1 3	1 5	1 7	1 9	1 11	1 13	1 15	2 1	2 3	2 5	2 8	2 10	2 12	2 14	700
800	0 2	0 5	0 7	0 9	0 12	0 14	1 1	1 3	1 5	1 8	1 10	1 13	1 15	2 1	2 4	2 6	2 8	2 11	2 13	3 0	3 2	3 4	800
900	0 3	0 5	0 8	0 11	0 13	1 0	1 3	1 5	1 8	1 11	1 13	2 0	2 3	2 5	2 8	2 11	2 14	3 0	3 3	3 6	3 8	3 11	900
1000	0 3	0 6	0 9	0 12	0 15	1 2	1 5	1 8	1 11	1 14	2 1	2 4	2 7	2 10	2 13	3 0	3 3	3 6	3 9	3 12	3 14	4 1	1000
2000	0 6	0 12	1 2	1 8	1 14	2 4	2 10	3 0	3 6	3 12	4 1	4 7	4 13	5 3	5 9	5 15	6 5	6 11	7 1	7 7	7 13	8 3	2000
3000	0 9	1 2	1 11	2 4	2 13	3 6	3 14	4 7	5 0	5 9	6 2	6 11	7 4	7 13	8 6	8 15	9 8	10 1	10 10	11 3	11 11	12 4	3000
4000	0 12	1 8	2 4	3 0	3 12	4 7	5 3	5 15	6 11	7 7	8 3	8 15	9 11	10 7	11 3	11 14	12 11	13 6	14 2	14 14	15 10	16 6	4000
5000	0 15	1 14	2 13	3 12	4 10	5 9	6 8	7 7	8 6	9 5	10 4	11 3	12 1	13 0	13 15	14 14	15 13	16 12	17 11	18 10	19 8	20 7	5000

The Velvet Bean.

By N. A. R. POLLOCK, H.D.A., Senior Instructor in Agriculture.

THE Podbearers, known as Velvet Beans, are grouped as species of the genus Stizolobium, syn. Mucuna, of the Natural Order Leguminosæ. They are recorded as natives of Tropical America, Asia, and Africa, with one from Fiji.[1]

As a farm crop the velvet bean is comparatively new, little attention having been devoted to it until within the last half-century. Prior to that the chief value of the genus was regarded as a source of the Cowhage or Cowitch of the materia medica, which was obtained from the species pruriens and prurita.

The name Velvet Bean is derived from the velvety feel and appearance of the pods, particularly those of the Florida species.

The genus comprises upward of twenty species, but only five have been deemed worthy of cultivation. These are the Lyon; Chinese; Yokohama, the pods of which are covered with short white or greyish hairs; Mauritius; and Florida, the pods of which are covered with short thick black velvety hairs.

There are at present a considerable number of varieties obtained by selection from species and their cross breeding. These vary in the colour of the flowers, length of pods, and colour of seeds, which may be white, brown, mottled, or black, as well as in their period of growth to maturity.

The best-known variety in Queensland is the Mauritius, which is largely grown in the canefields of the North for a green manure. This variety is probably of later-maturing habit than others, as it takes usually sixteen weeks to produce the first flowers and twenty-seven weeks to ripen the first pod. The seeds are shining black, rather flat, with a prominent white hilum, three to five being contained in a pod about 4 inches long.

The *Early Georgia,* a variety of the Florida species, is perhaps the earliest to mature, flowers forming in about eight weeks from germination of the seed and the first pods ripening in about nineteen weeks. The ripe pods are black, very hairy, 2 to 2½ inches long, and contain three or four seeds. The seeds, about the size of a marble, are oval or rounded, light in colour, with brownish black mottling.

The *Yokohama* is what may be termed of mid-season maturity, taking twelve weeks to flower and about twenty-two weeks to ripen the first pods. The pods are from 4 to 5 inches long, and contain usually five seeds of dull or greyish-white colour, flat, oblong, and often slightly depressed at the sides.

Early-maturing varieties are suggested in E. Georgia, Early Black, E. Arlington, Alabama, 100-day Speckled, &c.

Medium-maturing varieties are Yokohama, Lyon, and Chinese.

Late-maturing varieties are Mauritius and White Stingless.

[1] Nicholson, Encyclopedia of Horticulture.

Climate.

The Velvet Bean being native of tropical latitudes can be expected to give the best return in the Northern parts of the State, but good yields may be expected during the summer in all parts when early maturing varieties are sown and sufficient rain falls to provide the necessary soil moisture. Being of comparatively long-season growth the seed of any variety should be sown early and as soon after danger from frost is past as possible, especially in cooler parts.

Soils.

The Velvet Bean will succeed on a wide range of soils from a coarse sand to a heavy clay loam, provided they are sufficiently well drained. The best growth can naturally be expected on a free-working fertile loam. Low-lying soils that are apt to become water-logged are not suited to the crop, as owing to the dense foliage produced the free circulation of air is not permitted, and rotting is likely to result.

PLATE 62.
Early Georgia Velvet Beans, Tolga, ten weeks growth.

Uses.

Green Manure, being probably the most vigorous of all legumes cultivated, the volume of growth commends the Velvet Bean as a crop to be ploughed under as a green manure, to restore organic matter in the soil. In common with many other legumes, the nodules formed by the nitrogen-fixing bacteria are plentiful on the extensive root system, thus adding materially to its value in that respect.

Hay or Grazing.—The vines either green or cured as hay form a nutritious and palatable fodder for stock. In curing for hay the vines

must necessarily be cut by hand. Soon after the first flowers have formed is regarded as the best time, as the vines will then be less coarse. Shortly after wilting they should be put into cocks through which the air will readily circulate. As with other legumes the chief food value lies in the leaves, the retention of which is of major importance. In favourable weather, after the lapse of a few days the hay can be stacked, when, if the vines are not quite cured, a mild fermentation will perhaps render the vines more digestible or attractive as in brown lucerne hay. This fermentation, however, should not be sought, as it can go too far, and the aim should be to stack properly cured with a full retention of the leaves.

PLATE 63.
One Plant Early Georgie Velvet Bean, Tolga—ten weeks' growth.

Feeding-off.—The heavy yield of nutritious fodder renders the crop attractive for feeding-off, and excellent results, both in fattening and milk production, are reported from grazing cattle thereon. It also provides a profitable range for pigs. As the plants are of vigorous and long-continued growth, a daily period of grazing by dairy cows, with a final ploughing under as a green manure, should be profitable.

PLATE 64.
Velvet Beans, Toonpan, Townsville.

PLATE 65.
Velvet Beans growing amongst maize, Kairi, Atherton Tableland.

For Ensilage.—As an addition to maize or sorghum for ensilage, the Velvet Bean from its high protein content is of value. When grown conjointly the vines will climb the stalks, facilitating harvest. Grown in this manner also, the mixed crop has an added value when fed-off by pigs.

Seed.—The seeds form a valuable concentrate much relished by stock. Being usually as large or larger than a schoolboy's marble, farm animals can be expected to masticate them sufficiently for digestion. Crushing or grinding to a meal with or without the pod, which has some food value, however, is regarded as most economical. The green seeds, shelled as in the manner of Broad Beans or Lima Beans, are often esteemed for human consumption.

A heavier yield of seed is obtained when the plants are supported (see under "Cultivation.")

Cover Crop.—As a cover crop to keep down weeds, the heavy and long continued growth of the Velvet Bean commends it. When a field has become heavily weed-infested with growths hard to keep down or eradicate, the crop is of material advantage. It may be found of much value in this direction where the land is infested with Johnson grass.

Analyses.

From Henry and Morrison's "Feeds and Feeding," the following analyses are extracted to show the fodder value of the Velvet Bean:—

—	Total Dry Matter in 100 Lb.	Digestible Nutrients in 100 Lb.				Nutritive Ratio.
		Crude Protein.	Carbohydrate.	Fat.	Total.	
Seed	88·3	18·1	50·8	5·3	80·8	1 : 3·5
Seed and Pod	87·7	14·9	51·7	3·8	75·3	1 : 4
Hay	92·8	12·0	40·3	1·4	55·5	1 : 3·6
Green Material	17·9	2·7	7·2	0·4	10·8	1 : 3

Cultivation.

The land should be ploughed at least 6 inches in depth—cross-ploughed if necessary—and harrowed to produce a good tilth, as with other crops.

The seed is usually sown singly at intervals of 1 foot or 18 inches apart, in drills 4 to 5 feet apart. Sometimes the seed is sown in hills 3 feet apart; 10 to 20 lb. are regarded as sufficient for an acre. Inter-row cultivation should be practised to keep down weeds until the vines spread, probably over a period of four weeks, when the crop will need no further attention.

When sown as a mixture with maize or sorghum for grazing-off or for silage, the seed may be sown in the drill at the same time or after the maize or sorghum has germinated. In tropical parts, where the cereal makes a more rapid growth, it is perhaps preferable to sow the velvet bean seed, at the same time spacing the seeds 3 or more feet

apart in the drill. In cooler parts, it is advised to sow after the cereal has germinated at the time of its first cultivation or within three weeks.

Where the yield of seed is important or where it is to be saved separately from the hay, growth on tripods is recommended. These tripods can be formed of bush poles, say, 10 feet long, loosely wired about 2 feet from the top, so that two legs will rest on one drill and the third on the next. Tripods should alternately face reverse directions, and should be erected when the vines are growing towards the centre of the rows, after some cultivation has been given.

PLATE 66.
A Velvet Bean Crop in the Lower Burdekin District.

Grown on tripods, or in situations where the vines will be elevated, a very much greater yield of pods and seed will result. As much as double and treble such yield can be expected over plants running on the ground. Not only is the yield increased by growing on tripods, but the pods are much more easily harvested, since they will hang in bunches of as many as twenty or more, while those of prostrate growth will occur in much fewer numbers. Harvest of the vines, which have some value when the pods are removed, is facilitated when grown on the poles of the tripod, or they can be ploughed under when the poles are removed.

Yields.

The yield of vine growth will be determined by the soil and seasonal conditions and the period of growth, but 20 tons per acre of the green material in the case of the Mauritius variety is not unusual, and 10 tons or more per acre of the early-maturing sorts can be expected on reasonably fertile soil in a favourable season.

The yield of seed may be anything up to 30 bushels per acre with early-maturing varieties, or 50 bushels with medium and late maturing

kinds. When grown on tripods, however, the yield is much increased, and as many as 100 bushels per acre have been obtained in other countries.

The following yields were recorded in trials made some years ago in the Northern district:—

At Tolga—Early Georgia variety, 10 tons 18 cwt. per acre of green stuff when the first pods were setting.

At Millaa Millaa—Sown 2nd November, estimated 3rd March: Early Black, 18 tons per acre of green material; Early Georgia, 14 tons 9 cwt. per acre of green material; Mauritius, 11 tons 5 cwt. per acre of green material.

PLATE 67.
Velvet Beans, Lower Burdekin—a closer view of Plate 66.

Shelling the Seed.

While some of the varieties have thin pods, which readily break when dry to release the seed, others, such as the Mauritius, present thick hard shells, which are more difficult to treat.

Machinery to shell the seed is available, but in its absence it is advised to spread the pods exposed to the hot rays of the sun. When thoroughly dry a sprinkling with water from a hose or watering-can will cause the shells to shrink and burst open, thus releasing the seed.

For home use the whole pods can be ground, and the coarse part of the pods sifted out from the meal. Pigs have no trouble in shelling the pods, which should be fed to them whole.

Diseases.

The Velvet Beans appear to be remarkably free from disease, no instance of such having been recorded in the State, or as far as is known

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

Crop Prospects.—The month of June yielded but little rainfall, and the consequential depreciation of the pastures, coupled with the cold weather, has been reflected in a falling-off in the output of dairy products. The paucity of the rainfall also has retarded the preparation of the land for fodder crops for early spring sowing. The decreased output on the dairy farms has been compensated for to some extent by improved values for commercial butter as a result of the operations of the Butter Stabilisation Scheme.

Sugar.—The past month was associated with cooler atmospheric conditions, and crop growth has been retarded in all areas as a consequence. The season is one in which a high degree of flowering is being experienced. This means that further growth will not be possible, and a continuance of moist conditions will be necessary to ensure the absence of over-maturity before harvesting.

PLATE 68.—ON THE ROAD TO ROSEWOOD.

From a point near Minden, overlooking the rich farming lands of Marburg. Red and cocoa-coloured soils, covered originally by dense vine jungle, are characteristic of the Rosewood district, one of the most productive provinces in the State. This country has emerged from untrodden jungle to its present intensity of agricultural development in the short span of a single generation of Queensland pioneers.

Early reports from those mills which have commenced crushing operations suggest that the cane is of high sugar content this year, and on the preliminary estimates there is every probability that the sugar tonnage which will be produced will fall little below that of 1933.

Wheat.—The lack of rain has been felt particularly in the farming districts beyond the Range. The precipitations which were received at the end of the month over a large portion of the wheatgrowing area were generally of a light nature and only sufficient to freshen up the growing crops. Except on areas which had received an early cultivation and

where good bottom moisture was present in the soil the fall on the whole was insufficient to permit of completing the main sowing.

In the Maranoa the dry spell has been of longer duration, practically no rain having fallen in May and, in addition, the district has been invaded by a plague of grasshoppers which has caused considerable damage to young seedling wheat. The greater part of the Maranoa wheat area, however, still remains unsown.

Canary Seed.—Other States of the Commonwealth, particularly South Australia and Western Australia, now are giving attention to the cultivation of canary seed, and as the market for this grain is limited Queensland growers have been warned of the dangers of overproduction. It has been estimated that States other than Queensland will harvest 500 tons of canary seed this year.

PLATE 69.—FERTILE FARMING LANDS IN SOUTHERN QUEENSLAND.
Looking towards Marburg from Minden.

Maize.—Harvesting of the late crop is now being carried out and, with the exception of some of the more inland districts where yields are light owing to dry conditions fairly good results are being obtained.

Large quantities are being held on the farms awaiting an improvement in the price.

Cotton.—The killing frosts commencing in mid-June have hastened the opening of the top bolls, thus allowing of the completion of the harvesting which is required in order to enable new crop preparations to start.

Owing to the completion of the first picking and the consequent lessening of pressure of receivals at the ginneries the Gladstone plant was closed on the 15th June. The Glenmore and Whinstanes plants are still operating busily with prospects of continuing for a couple of months, for a big top crop still remains to be harvested.

The ginnings to the 22nd June total 12,289 bales of lint, which is a record for the State, the individual ginnery outputs being: Glenmore, 6,130 bales; Gladstone, 2,170; and Whinstanes, 3,989.

Tobacco.—Harvesting now has been completed in areas subject to frost, and although in the frost-free districts of the North leaf is still being harvested, the cold weather has retarded the ripening of the leaf and, as a result, curing troubles are being experienced.

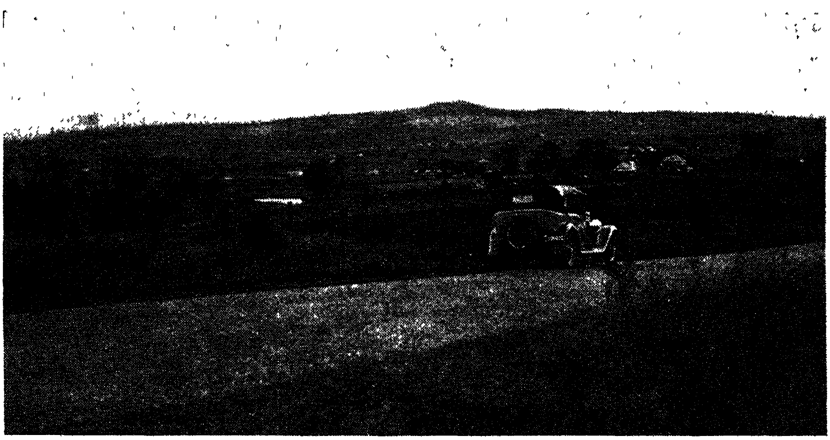


PLATE 70.—A HALT ON THE HIGHWAY TO THE DARLING DOWNS.
The country around Marburg, a district of comfortable homesteads, fertile fields, and agricultural abundance.

Tobacco growers are busily engaged in the grading of the leaf, uprooting and destruction of old plants to eliminate breeding grounds for pests and diseases, and in ploughing operations to permit of the land lying fallow until next planting season.

Melbourne Centenary Celebrations.—A display representative of Queensland's primary industries is to be staged in Melbourne for the Centenary Celebrations. The exhibit is to include wool, cotton, cereals, tobacco, and fruits. Tropical fruits such as pineapples, bananas, and pawpaws are to be featured, and an endeavour will be made to include plants bearing the different fruits.

The display is to be housed in the Melbourne offices of the Queensland Tourist Bureau.

LOSSES CAUSED BY SOIL EROSION.

The enormous economic losses caused by soil erosion in the United States of America are described by Mr. H. H. Bennett in "The Ohio Journal of Science." Mr. Bennett states that more than 100 million acres of the 350 million in cultivation in the United States have lost all or most of the precious material called top soil. At least 160 million acres of the remainder are suffering in some degree. To date, the essential destruction of about 35 million acres of what formerly was largely good crop land, together with an enormous additional area of grazing land, has been permitted. The land has been so deeply washed, so cut to pieces by gullying, or so smothered with the products of erosion that it cannot be reclaimed upon any practical basis by the average farmer. Much of it is permanently destroyed. Bedrock has been reached in countless places and deep gullies have torn asunder millions of sloping acres. All of this has been abandoned.

Land for Grazing Selection.

ELDERSLIE RESUMPTION.

A SUBDIVISION of Elderslie Resumption, situated about 28 miles westerly from Winton, will be opened for grazing homestead selection at the Land Office, Winton, on Tuesday, 21st August. The area of the block is 25,400 acres. The land will be opened for a term of lease of twenty-eight years at an annual rental of 1¾d. per acre for the first seven years of the term.

The whole area is very open to lightly-shaded downs with small patches of stony hills. It is artificially watered by an artesian bore fitted with a pumping plant and mill, and by a sub-artesian bore fully equipped with a pumping plant. These supplies are sufficient.

Other improvements include boundary netting and wire fencing and intersecting wire fencing, paddocks, huts, shed, yards, spraying race, &c., valued provisionally at about £3,000.

The selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

The existing marsupial netting fencing will require to be maintained marsupial-proof throughout the term of lease.

Free lithographs and full particulars may be obtained from the Land Agents, Longreach and Winton; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence and Tourist Bureaux, Sydney and Melbourne.

PLATE 71.
Lake Manchester, near Brisbane, Queensland.

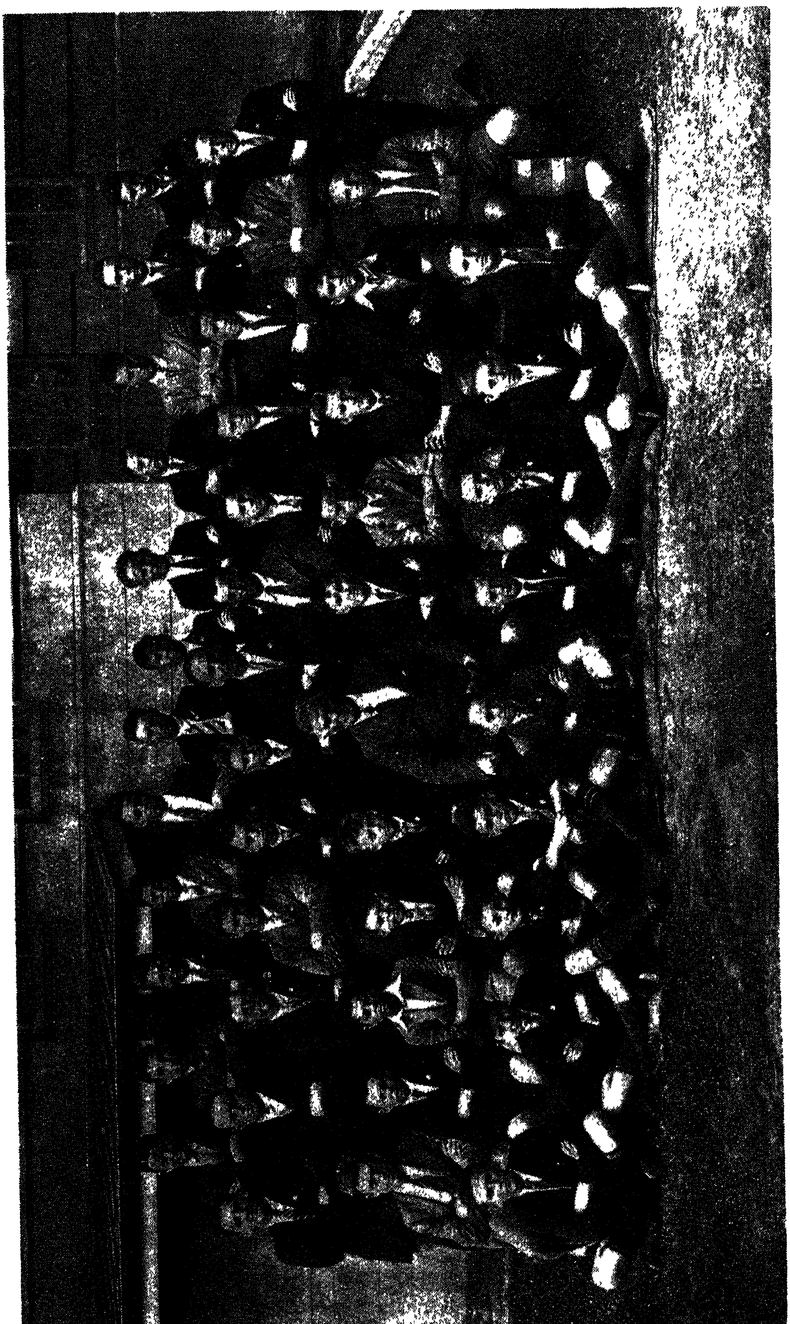


PLATE 72.—BRISBANE GRAMMAR SCHOOL GROUP.

On the occasion of an instructional visit of the boys to the Laboratories of the Department of Agriculture and Stock on 25th May, under the guidance of Mr. Dakin (seated in the centre), of the B.G.S. Teaching Staff.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled for the month of May, 1934 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Evelyn of Sunnyview	J. Phillips, Wondai	22,575·07	904·236	Diamond of Greyleigh
Princess V. of Cascade	C. O'Sullivan, Greenmount	12,897	463·449	Royal Rupert of Cascade
Pearl 6th of Quarnlea	Lehfeldt Brothers, Kalapa	12,932·78	454 16	Colonel of Blacklands
Rosebud of Happy Valley	R. R. Radel, Coalstoun Lakes	8,611 6	365·714	Mollys Hero of Glenthorn
Eva 12th of Quarnlea (261 days)	Lehfeldt Brothers, Kalapa	10,779·39	360·279	Fairplay of Burradale
Violet of Happy Valley	R. R. Radel, Coalstoun Lakes	8,088	357·104	Chief of Hillview
SENIOR, 4 YEARS OLD, STANDARD 330 LB.				
Primrose 8th of Quarnlea	Lehfeldt Brothers, Kalapa	9,431·7	343·323	Nuggets Lad of Hillview
Happy Valley Belles Molly	R. R. Radel, Coalstoun Lakes	7,734·9	332·812	Mollys Hero of Glenthorn
Villa Maria Reddy 6th	J. Buckley, Ross Hill	7,565·5	332·528	Villa Maria Sarsfield
JUNIOR, 4 YEARS OLD, STANDARD 310 LB.				
Pearl 17th of Quarnlea	Lehfeldt Brothers, Kalapa	8,752·48	385·177	Nuggets Lad of Hillview
Victory of Cedar Grove	A. C. Stewart, Coondoo	6,425·8	331·587	Mabel 2nd Victor of Coral Grange
Mountain Home Gem 6th	N. C. Lester, Laidley Creek West	8,295·56	328·172	Headlight of Greyleigh
SENIOR, 3 YEARS OLD, STANDARD 290 LB.				
Ashdale Daisy	A. Frank, Boonah	12,324·3	541·895	Diamond of Greyleigh
JUNIOR, 3 YEARS OLD, STANDARD 270 LB.				
Morden Sparkle	R. Mears, Toogoolwaah	12,671·05	541·266	George of Nestles
Miss Vesta II. of Blacklands	S. L. Holmes, Goomburra	7,880·5	308·126	Red Prince of Blacklands
Tottie 13th of Yaralla	H. Embrey, Rosewood	6,392	300·424	Southern Cross of Raleigh

SENIOR, 2 YEARS OLD, STANDARD 250 LB.				
Lynthorne Betty (265 days)	G. A. Meyers, Imbil	9,257·45	419·252	Plumstone of Blacklands
Lynthorne Peggy	G. A. Meyers, Imbil	8,362·15	365·437	Plumstone of Blacklands
Lynthorne Ida	G. A. Meyers, Imbil	8,999·25	361·757	Plumstone of Blacklands
Eva's Pride of Quarnlea (262 days)	Lehfeldt Brothers, Kalapa	8,697·23	323·47	Nuggets Lad of Hillview
Lynfield Success V.	V. Dunstan, Wolvi	7,651·55	309·811	Lavenders Pride of Blacklands
Lady Sal XIII. of Cedar Grove	A. C. Stewart, Coondoo	7,040·95	301·669	Duke of Cedar Grove
Navillus Mavis	C. O'Sullivan, Greenmount	6,904·75	285·403	Midgets Sheik of Westbrook
Glen Sally	A. C. Stewart, Coondoo	6,518·05	266·772	Lorna's General of Arley
JUNIOR, 2 YEARS OLD, STANDARD 230 LB.				
Star 2nd of Alfa Vale	W. H. Thompson, Nanango	10,922·95	436·685	Reward of Fairfield
Mabreen Tottie	V. Dunstan, Wolvi	9,308·25	357·182	Numbawarra Headlight
Rhodesview Nancy 6th	D. Gierkie and Sons, Helidon	8,631·25	347·229	Blacklands Prospector
Broady 7th of Villa Maria	S. L. Holmes, Goomburra	7,741·82	333·231	Graymare Gay Lad
Laguna Venus	F. G. Lamkin, Kaimkillenbun	7,982·86	320·773	Fuchsias Monarch of Rosenthal
Cedargrove Gusty 2nd	P. D. Fiechtner, Greenmount	7,140·15	307·489	Duke of Cedar Grove
Cedargrove Lady Prim 11th	P. D. Fiechtner, Greenmount	7,486·93	306·027	Duke of Cedar Grove
Rosenthal Lilac 4th	S. Mitchell, Warwick	6,765·75	292·227	Vain Prince
Navillus Olive 3rd	C. O'Sullivan, Greenmount	7,099·92	283·383	Midgets Sheik of Westbrook
Ashdace Lady Diana	A. Frank, Boonah	8,305·65	282·08	Red Knight of Kelston
Cedargrove Reddy 6th	P. D. Feichtner, Greenmount	6,409·88	281·412	Duke of Cedargrove
Cedargrove Iris	P. D. Feichtner, Greenmount	6,778·08	279·749	Duke of Cedargrove
Cedargrove Venus 6th	P. D. Feichtner, Greenmount	6,899·96	274·872	Duke of Cedargrove
Cedargrove Reddy 7th	P. D. Feichtner, Greenmount	6,443·6	268·164	Duke of Cedargrove
Daisy of Lynfield	F. E. Birt, Sexton	6,969·9	263·013	Lavenders Pride of Blacklands
Cedargrove Rosina II.	P. D. Feichtner, Greenmount	6,274·62	260·676	Duke of Cedargrove
Molly Belle of Happy Valley	R. R. Radel, Coalstoun Lakes	5,830·35	254·134	Venture of Happy Valley
Jubilee B of Rosenthal	F. G. Lamkin, Kaimkillenbun	5,798·64	253·82	Rosenthal Handsome Boy
Primrose VII. of Glenthorn	S. L. Holmes, Goomburra	6,683·24	246·479	Shamrocks Triumph of Burradale
Happy Valley Annie 5th	R. R. Radel, Coalstoun Lakes	5,313·55	240·691	Venture of Happy Valley

Production Recording—*continued.*

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
	JERSEY.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Trecarne Rosella	T. A. Petherick, Lockyer	9,613·32	601·243	Trinity Officer
Pineview Lucy	J. Hunter and Sons, Borallon	10,175·55	576·135	Carnation Lad
Trecarne Empress II.	R. A. Slaughter, Clifton	7,066·4	365·971	Carnation Royal Scot
Seycombe Gladness	C. Seymour, Coalstoun Lakes	5,874·4	356·569	Carnation Royal
	SENIOR, 4 YEARS OLD, STANDARD 330 LB.			
Pineview Model	J. Hunter and Sons, Borallon	9,951·3	620·592	Pineview Noble Lad
Ruth of Ipsley (365 days)	J. A. Rudd, Yeerongpilly	9,163·66	539·304	Rhuban of Ipsley
Oxford Graceful	F. Nimmo, Rosewood	7,088	388·546	Trinity Ambassador
	SENIOR, 3 YEARS, STANDARD 310 LB.			
Lavender of Calton	J. Collins, Tingoora	12,105·97	605·795	Prince Clare of Calton
	JUNIOR, 3 YEARS, STANDARD 270 LB.			
Pineview Noble Buttercup	J. Hunter and Sons, Borallon	7,454·04	449·223	Oxford Buttercups Noble
Trecarne Coronation	D. R. Hutton, Cunningham	7,178·6	410·87	Trecarne Golden King
Eldon Lavender	J. B. Keys, Gowrie Little Plains	7,408·78	384·373	Retford Raleighs Chief
Glenview Springfield	F. P. Fowler and Sons, Coalstoun Lakes	5,818·5	336·13	Carlyle Larkspur 2nd Empire
Creamys Lady of Inverlaw	R. J. Crawford, Inverlaw	5,304·05	303·968	Bruce of Inverlaw
	SENIOR, 2 YEARS, STANDARD 250 LB.			
Oxford Astor Daisy	E. Burton and Sons, Wanora	7,568·83	510·208	Trinity Ambassador
Ripple of Ipsley	J. A. Rudd, Yeerongpilly	4,759·24	296·699	Ray of Ipsley
Seycombe Granny	C. Seymour, Coalstoun Lakes	3,994·75	250·918	Carnation Prince Charles
Overlook Remus Fawn	H. Burton and Sons, Wanora	6,995·25	400·055	Overlook Favourite Remus
Oxford Queen Daffodil	E. Burton and Sons, Wanora	6,224·55	374·495	Trinity Ambassador

College Fleur	Queensland Agricultural High School and College, Gatton	6,069·22	369·245	Burnside Defender
Trecarne Jersey Queen	T. A. Petherick, Lockyer	5,685·54	329·395	Trecarne Golden King
Pineview Lexie	J. Hunter and Sons, Borallon	5,461·85	314·203	Oxford Buttercups Noble
College Mildred	Queensland Agricuturlal High School and College, Gatton	5,691·18	305·956	Burnside Renown
Newhills Sirus	J. Nicol Robinson, Maleny	4,656·75	303·405	President of Brooklodge
Irene's Joyce of Wattle View	E. C. Groves, Kandanga	4,470·1	284·243	Prince Royal of Wattle View
Bellgarth Birthday	D. R. Hutton, Cunningham	5,270·5	279·963	Bellefaire, Blondes Bellringer
Glenview Hazel	F. P. Fowler and Sons, Coalstoun Lakes	4,611·05	277·535	Trinity Officer
Trecarne Rosella 6th	T. A. Petherick, Lockyer	4,489·57	261·448	Trecarne Golden King
College Dina	Queensland Agricultural High School and College, Gatton	4,672·17	260·300	Burnside Renown
Bellgarth Dawn	D. R. Hutton, Cunningham	5,212·5	252·322	Bellfaire Blondes Bellringer
Trecarne Sweetheart	T. A. Petherick, Lockyer	4,220·06	238·995	Trecarne Renown
GUERNSEY.				
SENIOR, 2 YEARS OLD, STANDARD 250 LB.				
Linwood Betsy	A. S. Cooke, Maleny	5,508·6	285·232	Caramana Barrister
East Glyn Ballet Girl	A. S. Cooke, Maleny	4,510·7	250·327	Caramana Prince
Laureldale Beatrix	W. A. Cooke, Maleny	5,250·5	248·784	Moonji Naughty Boy

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 3rd July, 1934, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for July, August, and September, 1934:—

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 10th July, 1934—"Preparing Pigs for Show." By L. A. Downey, Instructor in Pig Raising.

Thursday, 12th July, 1934—"The Principles and Practice of Pig Feeding. By L. A. Downey, Instructor in Pig Raising.

Tuesday, 17th July, 1934—"Plants Poisonous to Stock." By C. T. White, Government Botanist.

Thursday, 19th July, 1934—"Plants Poisonous to Stock." By C. T. White, Government Botanist.

Tuesday, 24th July, 1934—"A Ramble in Rural England and its Lessons." By J. F. F. Reid, Editor of Publications.

Thursday, 26th July, 1934—"An Excursion to Scotland—Livestock Studies." By J. F. F. Reid, Editor of Publications.

Tuesday, 31st July, 1934—"Queensland—A Fruitful Country." By J. F. F. Reid, Editor of Publications.

Thursday, 2nd August, 1934—"The Story of Butter and Cheese throughout the Ages." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 7th August, 1934—"The Packing and Preparation of Tomatoes for Market." By J. H. Gregory, Packing Instructor.

Thursday, 9th August, 1934—"The Avocado in Queensland and Elsewhere." By H. Barnes, Director of Fruit Culture.

Tuesday, 14th August, 1934—"Packing Shed Hygiene." By J. H. Gregory, Packing Instructor.

Thursday, 16th August, 1934—"The Importance of Citrus Bud Selection." By H. Barnes, Director of Fruit Culture.

Tuesday, 21st August, 1934—"Papaw Cultivation." By H. Barnes, Director of Fruit Culture.

Thursday, 23rd August, 1934—"The Pasteurisation of Milk and its Products." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 28th August, 1934—"Vitamins in Dairy Products." By O. St. J. Kent, B.Sc., Analyst.

Thursday, 30th August, 1934—"Factors Influencing the Amount of Fat in Milk." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 4th September, 1934—"Seasonal Farm Crops," Part I. By C. J. McKeon, Instructor in Agriculture.

Thursday, 6th September, 1934—"Seasonal Farm Crops," Part II. By C. J. McKeon, Instructor in Agriculture.

Tuesday, 11th September, 1934—"Seasonal Farm Crops," Part III. By C. J. McKeon, Instructor in Agriculture.

Thursday, 13th September, 1934—"The Tobacco Industry Protection Act of 1933." By H. S. Hunter.

Tuesday, 18th September, 1934—"Some Requirements of Plant Growth." By E. H. Gurney, Agricultural Chemist.

Thursday, 20th September, 1934—"Fertilizers and Manures." By E. H. Gurney, Agricultural Chemist.

Tuesday, 25th September, 1934—"Nutritive Value of Pasture." By E. H. Gurney, Agricultural Chemist.

Thursday, 27th September, 1934—"Mineral Ingredients in Stock Foods." By E. H. Gurney, Agricultural Chemist.

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Red Natal Grass.

E.A.T. (Stanthorpe)—

The specimen is *Rhynchyleytrum roseum* (Red Natal Grass). This grass is very common in many parts of Queensland, particularly in the coastal belt, where it is very abundant along railway cuttings, in pineapple and banana plantations, and, in fact, anywhere where the ground has been disturbed. It is not a particularly valuable grass for grazing, but is much used mixed with more palatable fodder as a chop-chop for working horses. It has a very light hold of the ground, and is eeasily pulled up by stock.

Berrigan.

M.M.K. (Springsure)—

The specimen is the Berrigan (*Eremophila longifolia*), a small tree or shrub, a native of Western Queensland and New South Wales. It should make an excellent garden shrub for dry places as it seems to stand dry weather remarkably well. The plant is quite a good fodder, and chemical analysis shows its nutritive value to be fairly high. In rabbit-infested areas it is said to be very hard to grow the shrub owing to the ravages of rabbits, which are exceedingly fond of the bark of this tree. Mr. Fred Turner, the well-known authority on grasses and fodder plants, in one of his books says that in certain parts of New South Wales large numbers of shrubs have been destroyed by rabbits eating the bark a few feet up the stems from the base. We were very interested to learn that the plant had transplanted so well, as it has generally been regarded as somewhat difficult to transplant. We are very keen on seeing the native trees and shrubs used more extensively for private and garden planting.

"Wild Lucerne."

J.W.H. (Caboolture)—

This plant first made its appearance in North Queensland a little over twenty years ago, but is reported to have been in the Northern Territory before that. It is now very abundant both in many parts of Queensland and the Northern Territory. Its botanical name is *Stylosanthes sundaica,* although it has previously gone under various names in Queensland—e.g., *Stylosanthes mucronata* and *Stylosanthes procumbens.* We think there is little doubt that where it has been introduced it has definitely increased the carrying capacity of the land. Its only drawback is that it is an annual. It generally germinates with the early summer rains, and is in full growth in January and February, but as far as we have observed stock do not care for it in its very green and luscious state, eating it very readily when it is drying off somewhat. This is rather a valuable feature, as the plant is dying off in the late summer and early autumn when other food is rather scarce. Experienced stockowners have told us that all classes of stock will lick up broken pieces of the dried plant in somewhat the same way as the Flinders Grasses. Chemical analysis carried out at the Agricultural Chemist's laboratory, Brisbane, shows the plant to approximate ordinary lucerne in nutritive value. As far as Australia is concerned, the plant was first recorded from the neighbourhood of Townsville, where it was looked upon as a weed of lawns, and hence is frequently known as Townsville Lucerne. It has been thought by some people that it may injure the native grasses by dying out and leaving bare patches, but as far as our experience goes this plant and the grasses seem to grow quite well together.

Emu Grass ("Dalby Wild Lucerne").

R.S. (Dalby)—

The specimen of "Dalby Wild Lucerne" has been determined as *Psoralea tenax.* This is a leguminous plant and is sometimes called Emu Grass. It is a native plant with a good reputation for fodder value.

Night Shade.

G.R.I.A. (Gympie)—

The specimen from Kilkivan has been identified as the Garden Night Shade (*Solanum nigrum*). It is widely spread over the warmer temperate regions of the world, and is a very common farm and garden weed in Queensland. The ripe berries are eaten by children, often in quite large quantities, without any ill effects. They are also commonly cooked for pies under the familiar name of blackberries, although, of course, they are quite distinct from the true blackberries of Europe and North America. The berries when green, however, are decidedly poisonous, and this applies, no doubt, to the other green parts of the plant. On this account the plant should be destroyed. Cases of poisoning in live stock are rare, and we were surprised to learn that the cattle had been eating it, for on the whole it is a plant rather rejected by them. The symptoms given are stupefaction, staggering, loss of feeling of consciousness, cramps, and sometimes convulsions. As in respect of many other plants of the Solanum family, or *Solanaceæ*, the pupils of the eyes of affected animals are generally dilated. The poisonous principle is an alkaloid Solanine. The eradication of the plant is recommended.

Groundsel Bush.

J.R. (Yeerongpilly)—

The specimen from Gympie has been determined as *Baccharis halimifolia*, the Groundsel Bush, a native of South America, and now a very common naturalised weed in Queensland. It has overrun many farms on the North Coast line, particularly towards the coast, on land that is sometimes subject to inundation. It is, however, not confined to such places, for we have had specimens from scrub farms on the Blackall and D'Aguilar Ranges. It is sometimes called Arsenic Bush, a name applied rather indiscriminately to some plants in Queensland, and this name does not seem justified. As some members of the genus have been suspected of poisoning stock in South America, feeding tests were carried out with this plant at Yeerongpilly some years ago, and after ten days to a fortnight's feeding the heifers were very thin and emaciated, but recovered when put back on to ordinary food. We should certainly say these heifers ate more of the plant than they would under natural conditions. From this it would seem that the plant has no fodder value, but is not poisonous. Some farmers on swampy coastal country in the neighbourhood of Noosa have told us that stock will browse on the plant, especially in drought time, and they have not noticed any ill effects from it.

A Common Weed (*Phaseolus lathyroides*).

H.R.H. (Giru)—

The specimen is *Phaseolus lathyroides*, a native of tropical America, now a common naturalised weed in Queensland. Although fairly abundant, we have not heard a common name applied to it. It was introduced many years ago as a fodder, but on the whole our experience has been that stock do not take readily to it, at least when other feed is available, although on occasions we have had specimens with the report that stock were eating it freely enough. Although introduced so long ago it is only during the last two or three years that the plant seems to have spread very much outside south-eastern Queensland, and now it seems to be throughout the coastal belt. It is a common tropical plant, widely spread over the tropical and sub-tropical countries of the world, and is not known to be poisonous or harmful in any way. We think if plant poisoning is your trouble the cause must be looked for elsewhere.

Pigweed.

INQUIRER (Townsville)—

The plant is *Portulaca filifolia*, a species of Pigweed, a native of North Queensland and the Northern Territory. The plant seems particularly prevalent this year, as we have had several specimens forwarded for identification from the North-west and Central-west. Like other members of the Pigweed family, it is not known to possess any harmful or poisonous properties, but if eaten by stock in any quantity on an empty stomach would cause "hoven" or "bloat."

"Cape Cotton."

T.M. (Dayboro')—

It is rather difficult to correctly name plants from descriptions only The usual practice is to forward small pieces a few inches long bearing either flowers or seed, and when more than one specimen is sent each should be labelled and duplicates retained, when names corresponding to numbers will be returned. However, the particular weed you describe seems to be the so-called Cape Cotton, Balloon Cotton or Milky Cotton (*Gomphrena fruiticosus*), a native of South Africa, now common as a weed in secondary growth in much of coastal Queensland. It belongs to a dangerous family of plants, the *Asclepiadeæ*, and is probably poisonous, although so far as we have observed stock generally avoid it. The plant is sometimes grown in gardens as a curiosity on account of its balloon-like pods, but on many scrub farms it becomes a terrible curse, the seeds being widely spread by the wind. When cut the plant exudes a milky sap. The bark is very tough and possesses a rather useful fibre.

Guinea Grass.

W.H., (Pine Mountain)—

The specimen is the Guinea Grass (*Panicum maximum*), quite a valuable fodder grass, either for cutting or grazing off. It has been established in Queensland for a great many years, and judging from the number of specimens received during the last few months seems again to be coming into favour. We should say a grass such as Guinea Grass, Blue Panic, &c., would be valuable in small paddocks of, say, 2 to 5 acres for occasionally feeding down. Although it produces large seed heads, a big proportion of the seed is generally infertile, and propagation is probably best by division of the roots. This has probably affected the plant's popularity. It is not known to possess any poisonous or harmful properties at any stage of its growth.

Trees and Climbers Suitable for Longreach District.

A.McG. (Longreach)—

The trees worth while trying out at Longreach are—Currajong, Citron-scented Gum, Portuguese Elm (*Celtis sinensis*), Acacia (*Albizzia Lebbeck*), Parkinsonia Tree, Pepper Tree. Algaroba Bean, *Acacia arabica*, and Bottle Tree. Some of the Pines, such as the Native White Cypress (*Callitris glauca*), *Cupressus torulosa*, and the Chir Pine (*Pinus longifolia*), might be worth trying. Palms would be rather difficult to grow; the two you are most likely to succeed with would be the Cotton Palm and the Wine Palm (*Cocos Yatay*). Of climbers the following might suit:—Common Honey Suckle, Wistaria, Minettia, the Potato Vine (*Solanum Wenlandi*), Snail Flower (*Phaseolus caracolla*), and, if your frosts are not too severe, Bougainvilleas of different varieties.

In regard to vines that can be used both for ornament and for vegetables or fruits, the ordinary Passion Vine might grow if your frosts are not too severe. We do not remember having seen the Banana-fruited Passion (*Tacsonia mollissima*) in the West. It does not fruit well on the coast in Queensland, but your cold winters might aid in this respect. It fruits quite well in the neighbourhood of Sydney. Of climbing vegetables, two beans you could use are the so-called Poor Man's Bean or Hyacinth Bean (*Dolichos lablab*), or any of the climbing varieties of the Madagascar or Lima Beans. These would probably be best treated as annuals, although the Dolichos would last more than one year, provided your frosts are not too severe. The Botanic Gardens, Rockhampton, supplies plants, and some of the ornamental trees mentioned you could probably obtain from the Curator there, Mr. H. G. Simmons.

Wheat Grass.

A.E.H. (Mooloolah)—

The common Australian Wheat Grass is *Agropyrum scabrum*. It is very common in Queensland on parts of the Darling Downs. It is occasionally seen on the coast, but just as an occasional stranger. The grass varies very considerably in fodder value. The finer strains of it are found in the cooler parts of the State, and it is quite a good grass for the Granite Belt and parts of the Darling Downs, but in the warmer parts of the State it tends to become harsh and rather unpalatable. From our observations of the grass we should say it is primarily a sheep and cattle grass rather than one for the dairying districts.

Cockspur Thistle ("Saucy Jack"). Pimpernel. An Excellent Green Manure (*Phaseolus semierectus*).

D.O.A. (Atherton)—

(1) The taller growing plant with hairy leaves and stems bore only very young seed heads, but we should say it is *Centaurea melitensis*, the Cockspur Thistle, a very bad weed in the Southern States, where it is frequently known under the name of Saucy Jack. It is less common in Queensland, although it is often seen as a weed on farms on the Darling Downs.

(2) The other more succulent plant with green leaves bore neither flowers nor seed pods, but is evidently the Pimpernel (*Anagallis arvensis*), a very common weed on farm lands in the Southern States and in Southern Queensland. It is poisonous to stock, though only on rare occasions does it seem to be eaten by them.

Regarding *Phaseolus semierectus*, this plant is quite harmless. As a matter of fact, it was introduced as a fodder, though as far as we have observed stock do not take to very readily. We have had a lot of specimens in this year, and in some cases stock certainly do seem to be eating it, perhaps because other feed was not available. It is a native of Tropical America, but is now a naturalised weed in most warm countries. It is not known to possess any poisonous or harmful properties, and makes excellent green manure.

Mitchell and Flinders Grasses.

J.C. (Ilfracombe)—

In Dr. Hirschfeld's experiments, at least two sorts of Flinders Grasses and four sorts of Mitchell Grasses were experimented with. The seeds were sown in October, and, due to good late spring and early summer rains, there was a high percentage of germination, and the plants were in full growth in January. After the seed had been gathered from the Flinders Grasses stock were turned in late in April. The Flinders Grass had dried by this time, and what was left after seed had fallen proved very palatable to cattle, these grasses being sought first. Seed was not stripped from the Mitchell Grasses, and of the four varieties stock showed most preference for the Curly Mitchell, which is the commonest in Queensland. After that the Upright Mitchell, Hoop or Wire Mitchell, and Bull Mitchell were eaten in much the order given. It is often claimed by practical stockowners in the West that failure of Mitchell Grasses to germinate has been due to the absence of January rains, but in Dr. Hirschfeld's experiments the seeds definitely germinated with early summer or late spring rains. Our limited experiments at Lawnton and the Botanic Gardens have shown negative results. It is the opinion of stockowners that Mitchell Grass must be at least two years' old before stock are put on to it, otherwise they tear it up by the roots, but these conditions probably apply only to rather loose soil. Where the soil is heavy it would, we think, be quite safe to put stock on to Mitchell Grass within the first twelve months or even less. The trustees of the Walter and Eliza Hall Fellowship of Economic Biology of the Queensland University have recently appointed a Fellow for a term of three years to investigate the question of these native grasses. He is Mr. S. T. Blake, a graduate of the Queensland University, and it might be as well for you to get in touch with him. His address is care of the Biological Department, University of Queensland, Brisbane.

Broad-leaved Carpet Grass.

J.H.O. (Burrum)—

The specimen is the Broad-leaved Carpet Grass (*Paspalum platycaule*), a common tropical grass very abundant in North Queensland. It has been established in the more southern parts of the State for some years, and is now very much on the increase. It is quite a useful grass for second-class country, and on the whole we think much superior to the narrow-leaved variety that is causing some concern on the North Coast line as invading Paspalum pastures. This narrow-leaved variety of Carpet Grass is generally known as *Paspalum compressum* or *Axonopus compressus*, and is sometimes called Mat Grass. As far as we have observed in Southern Queensland, the Broad-leaved Carpet Grass (the form you send) prefers somewhat sandy land near the coast, and we do not think it is a potential danger to the better class Paspalum pastures.

General Notes.

Honoured by the King—Sir Geoffrey Evans, Former Director of Cotton Culture.

From the annual report of the Imperial College of Tropical Agriculture, now to hand, we learn that His Majesty the King, who is Patron of the College, has conferred on Mr. Geoffrey Evans the honour of Knight Bachelor. This is regarded as a well-merited recognition of his services to tropical agriculture.

Sir Geoffrey Evans is well known in Queensland, where he was some years Director of Cotton Culture in the Department of Agriculture and Stock, and where he has many friends to whom the news of the high distinction he has received from the King is especially pleasing.

In 1923 he was seconded by the Empire Cotton Growing Corporation as Cotton Adviser to the Queensland Government, and was later appointed Director of Cotton Culture while still retaining his association with the Corporation. His wide experience and organising ability were of great assistance to the cotton industry in this State during its early stages of development. In 1926 he was recalled to England and appointed Acting Principal of the Imperial College of Tropical Agriculture at Trinidad. In the following year he was appointed Principal, a post he has filled with marked ability and tact for seven years. Judging by the report, which covers a very wide field of instructional and research work, it is becoming increasingly evident that the efforts of the College to further the advancement of agriculture on scientific lines are recognised as of great value, and is widely appreciated.

Sir Geoffrey Evans served with distinction during the war, attaining the rank of Colonel with the decoration of C.I.E. Hearty congratulations are extended to him on the further recognition of his work and worth in the field of tropical agriculture.

Services of the Public Curator.

The following information is supplied by the Office of the Public Curator:—

The Office of the Public Curator has been specially created so that the people of Queensland will always have available a continuous service in all trustee and agency work, and thus avoid the many dislocations often evident in individual appointments. The service also provides for the preparation of taxation returns for clients.

The intricacies of modern tax legislation are not too readily understood by the bulk of the people, and the need is felt for advice from men who are fully conversant with all the requirements of the taxation authorities. No one is expected to pay more tax than is required, but often, because of lack of knowledge, taxpayers return as income moneys which should not be classed as such. The expert can advise you on all these and many other points, and help you in many ways to avoid bearing more than your equitable burden from taxation.

You are well advised to consider what help you need with your returns, which you are now required to lodge. The service includes, too, the receipt and checking of your assessment, and refers to all taxation returns, including land and income tax.

Another service to-day notified is that the Public Curator has always ample trust funds available for advancing on approved freehold security. You should call or write for further information direct to the Public Curator, Edward street, Brisbane, or to the Branches at Rockhampton, Townsville, and Cairns, or to any Clerk of Petty Sessions in the State. These latter are all agents for the Public Curator.

Order to Dip Stock.

Executive approval was given to the amendment of Regulations under the Diseases in Stock Acts dealing with the order of an inspector to dip infected stock. Actually, the amendments involve slight changes in the form of order to dip which the inspector issues to an owner of infected stock. The general procedure for the dipping and treatment of infected stock remains the same as that at present in force.

Staff Changes and Appointments.

Mr. H. J. D. McBean, Inspector of Stock, Milmerran, and J. T. Smallhorn, Inspector of Stock, Miles, have been appointed also Inspectors under the Dairy Produce Acts.

Mr. F. C. Coleman, Inspector of Dairies, has been appointed also an Inspector of Stock. Mr. Coleman is stationed at Pittsworth.

Acting Sergeant R. F. Dawson, Sarina, has been appointed also an Inspector of Slaughterhouses.

Mr. T. Ellis, loader for the Committee of Direction of Fruit Marketing at Eudlo, has been appointed also an Inspector under the Diseases in Plants Acts.

Mr. D. C. B. Nunn (Boonah) has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. A. M. Taylor, Clerk of Petty Sessions, Ayr, has been appointed an Agent of the Central Sugar Cane Prices Board for the purpose of making enquiries in pursuance of the provisions of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands, and the appointment of Mr. T. R. Kennedy, Bowen, as an Agent of the Board has been rescinded.

Constable J. W. Wilson (Turn-off Lagoons) has been appointed also an Inspector under the Slaughtering Act.

Mr. E. H. Harding (Palmwoods) has been appointed an Honorary Ranger under the Native Plants Protection Act.

Mr. A. F. Moodie, Inspector of Stock, Julia Creek, has been transferred to Hughenden, and Mr. C. E. Ellis, Inspector of Stock, who has been stationed at Hughenden, will be attached to the Killarney district.

Mr. S. E. Stephens, Instructor in Fruit Culture, at Cairns, has been appointed also an Inspector under the Apiaries Act and the Diseases in Stock Acts.

Constable A. McElrea, of Mourilyan, has been appointed also an Inspector under the Slaughtering Act.

Mr. L. G. Miles, B.Sc.Agr. (Q'ld.), who has been abroad for the past three years studying plant genetics, has been appointed Plant Breeder, Department of Agriculture and Stock.

Mr. R. Mahoney has been appointed Assistant Cane Tester at the Marian mill for the forthcoming sugar season, as from 18th July, 1934.

Messrs. C. H. Jorgensen and L. G. F. Helbach, whose appointments as Cane Testers at the Mourilyan and Isis mills, respectively, were recently approved, have now been appointed to the Isis and Mourilyan mills.

Constable J. E. Carroll (Stonehenge) has been appointed also an Inspector under the Brands Acts.

Mr. E. R. Ashburn, Instructor in Agriculture, Bowen, has been appointed also an Inspector under the Diseases in Plants Acts.

Messrs. N. C. Copeman and H. A. McDonald, Inspectors of Stock at Wandoan and Jandowae, respectively, and Mr. J. R. Canty, Inspector of Slaughter-houses at Innisfail, have been appointed also Inspectors of Dairies.

Grade Standards for Banana Plants.

Regulations have been issued under the Diseases in Plants Acts prescribing grade standards for banana plants, and no person shall sell or offer for sale any banana suckers or bits unless they comply with the standards prescribed. The standards are:—

Suckers.—A sucker is an offshoot from the corm of a mature plant from a planting not less than twelve months old, provided that the corm of such sucker shall be not less than three inches in any diameter below the point of commencement of development of the pseudostem.

Bits.—A bit is a portion of a mature corm of a banana plant, previded that such bit shall consist of a well-developed, undamaged "eye" protruding not less than ½ inch above the surface of the corm to which it is attached, the eye to be not less than 1½ inches from any edge, width of surface to be at least 4 inches, and depth behind eye at least 3 inches.

Suckers and bits intended for sale shall be removed by the vendor from his plantation on the same day as they are trimmed at least half a mile from any banana plantation, provided that an agent of the Banana Industry Protection Board may authorise their removal to a place which he considers safe from beetle-borer infestation.

Queensland Royal National Show.

The Queensland Royal National Show, to be held 6th to 11th August, is acclaimed by all sections of the community as the most important agricultural event of the year. Queensland's winter sunshine is attracting thousands of inter-State visitors to the Royal Show each year. This year's ring programme will extend over eleven sessions—six days and five nights—and will include one of the most comprehensive series of hunting, jumping, and trotting events so far presented in Brisbane.

In the Women's Section of the Show, which comprises Women's Industries in all branches—Arts and Crafts, Photography, Cookery, Home Preserves, &c.—entries are exceptionally heavy, thus ensuring a fine display. Queensland women are among the most resourceful in the world, and the work displayed in this section should attract great public interest.

The Royal National Show is first and foremost educational, and this phase is exemplified in the Farm Boys' Camp. Each year 15 boys are selected from the Project Clubs throughout Queensland; a party of 10 boys has been similarly selected in New South Wales for the Brisbane Show. This year the movement is to be further extended by the establishment of a Girls' Section. As a commencement, 10 girls will be selected as guests of the Association, and a similar syllabus to that of the boys will be prepared for their education and entertainment throughout Show Week. Each section of the camp will be under the control of responsible officials right from the time of their arrival in Brisbane to their entrainment for the homeward journey after the Show. The Boys' Section will be quartered in the Valley State School; while the contingent of girls will be accommodated at the Y.W.C.A.

The Wool Exhibit which was so successful last year is to be again staged, and will be considerably enlarged. It is anticipated that several hundred sheep will be housed on the showgrounds and frequent sheep-shearing demonstrations will be given throughout show week. It is surprising how few people have actually seen sheep being shorn, and these demonstrations afford a convenient opportunity for witnessing an important feature of this truly Australian industry. It is, perhaps, on the manufacturing side that the wool exhibition is most impressive, and the forthcoming displays will reflect remarkable progress in the production of beautiful and artistic articles of personal apparel fabricated from wool.

Brisbane Catchment Area a Bird Sanctuary.

An Order in Council has been issued under the Animals and Birds Acts declaring No. 5 Division, Shire of Moreton, the Brisbane Water Catchment Area, Mount Coot-tha Reserve, and adjoining lands as a sanctuary for the protection of native animals and birds.

The Brisbane Water Catchment Area, the Mount Coot-tha Reserve and adjoining lands were declared a sanctuary a few years ago. However, requests have lately been received for the declaration of sanctuaries in various parts of the No. 5 Division of the Moreton Shire, and as about one-third of this Division is already included in the abovementioned sanctuary, a new Order in Council to cover the No. 5 Division and lands previously declared a sanctuary has been issued.

Messrs. C. Christie, R. Worley, K. Williams, and C. Mason, of the Ipswich district, have been appointed Honorary Rangers under the Animals and Birds Acts. The property used by these Scouts for a training ground is situated within the boundaries of the abovementioned sanctuary.

Instructional Course for Dairy Farmers and Pig Raisers at Gatton.

Professor J. K. Murray, Principal of the Queensland Agricultural High School and College, Gatton, advises that a short course of instruction for dairy and pig farmers will be held from 13th August to 23rd August, 1934. The course will cover lectures and demonstrations, also visits to the Brisbane Abattoirs and bacon factories. The fees will total £3 10s., covering tuition, board, and visits to factories. Further particulars and rail concession forms on application to the Principal of the College at Gatton.

Cheese Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts giving notice of intention to extend the operations of the Cheese Board for the period from 1st August, 1934, to 7th February, 1935. Provision is made for the lodgment of a petition on or before the 16th July, to be signed by not less than 10 per cent. of cheese manufacturers and suppliers of milk to cheese factories, requesting that a poll be held on the question of the continuance or otherwise of the board.

Oversea Shipment of Poultry—Customs Department Requirements.

Following are the conditions of the Customs Department for acceptance of consignments overseas. These conditions are intended as a guide for shippers, and unless they are reasonably complied with the Customs Department may refuse to pass the birds for shipment—

For the crating of fowls, ducks, geese, and turkeys for shipment overseas, it is desirable that the coops be constructed of wood, and the front be covered either with wire-netting or slatted battens, the latter preferred. The top should be sloping and the boards lapped to shed any water. Where the birds have to travel through the tropics, ample ventilation should be provided by leaving an aperature of about 2 inches along the back near the top of the coop, or by holes 1 inch in diameter bored in the back and ends near the top.

Water vessels should be provided, preferably of a type which will hang on to the front of the coop with a metal strap.

The minimum sizes desirable for the various classes of birds mentioned being despatched on a journey of seven days or over are as under, but reasonable latitude may be allowed if the journey is under seven days, as to New Zealand and Lord Howe Island.

Fowls.—For single birds the coop should have a floor space of 3 square feet (2 feet × 1 foot 6 inches) and a height of 2 feet at the back and 2 feet 3 inches in the front. Where more than one bird is being sent, not less than 2 square feet of floor space per bird should be allowed, and not more than one male bird should be put in one compartment.

Ducks.—Coops should be constructed the same as for fowls, except that the height need not be more than 2 feet at the front. An allowance of 3 square feet of floor space (2 feet × 1 foot 6 inches) should be made for single birds or 2 square feet each where more than one bird is in the compartment.

Geese.—Coops should be of the same construction as for fowls except that the height should be 2 feet 3 inches at the back and 2 feet 6 inches in front. Five square feet of floor space should be allowed for single birds (2 feet 6 inches × 2 feet) or 3 square feet each where more than one bird is in the same compartment.

Turkeys (Gobblers).—Coops should be built in the same manner as for fowls, except that the height should be 2 feet 6 inches at the back and 2 feet 9 inches in front. About 9½ square feet of floor space (3 feet 9 inches × 2 feet 6 inches) should be provided for a single gobbler or 6 square feet each where more than one gobbler is in the same compartment, but preferably gobblers should be in separate compartments, in which case 9½ square feet should be allowed.

Turkey Hens.—For single hens the floor space should be 6 square feet (3 feet × 2 feet) or 4 square feet per bird where more than one is in the same compartment, and the height may be 3 inches less at front and back.

Quarantine Area on the Near North Coast.

A Proclamation has been issued, under the Diseases in Plants Acts, declaring the parish of Mooloolah and portions of the parishes of Bribie and Maroochy to be a quarantine area for the purposes of the Acts. This Proclamation also rescinds a Proclamation issued on the 27th February, 1930, which prescribed the existing boundaries of the quarantine area to be between the Maroochy River and the main Caloundra-Landsborough road.

This action has been considered desirable in view of the progress of bunchy-top infestation northward of the boundaries of the present area, and, in addition to taking in the areas where bunchy top has recently made its appearance, it will also provide what is looked upon as a safe margin.

Butter Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts extending the operations of the Butter Board for the period from 1st July, 1934, to 7th February, 1935. The Order further provides that the present members of the Board—namely, J. Purcell (Toowoomba) (chairman), W. J. Sloan (Malanda), R. M. Hill (Bororen), J. McRobert (Maryborough), T. F. Plunkett (Beaudesert), A. G. Muller (Fassifern Valley, Kalbar), and E. Graham (Director of Marketing), whose period of office terminates on the 30th June, shall continue in office until 7th February next.

Purchasing Store Pigs.

A word of advice to those who intend purchasing or who regularly make a practice of buying store pigs will not be out of place, seeing that a number of instances have been recorded recently in which bad results have followed the purchases and money has been lost on the transaction. Inexperienced persons who set out to purchase pigs for finishing for market should endeavour, wherever possible, to secure pigs not less than fourteen or sixteen weeks old.

It is disastrous buying pigs six weeks old and expecting them to make progress or to prove satisfactory, especially as these very young unweaned pigs often cost more at auction than those carrying more age. There is an old saying, "Never buy a pig in a poke," which literally means never buy a pig of whose breeding or development you know nothing. Fortunately, under the conditions on which pigs are offered for sale at public auction in this State, the buyers' name and postal address must be announced before the pigs are offered for sale, but though this is a valuable safeguard against the spread of disease it is not everything, and buyers should certainly know something of the conditions under which the pigs intended to be purchased have been developed, the foods used in their production, whether they come from a farm free of disease, the breeding, age, and any other information available. The purchase of pigs from breeders with a well-known good reputation is usually a safe proposition, and it would be preferable to purchase only from well-known breeders if we are to succeed in our efforts to eradicate and/or trace disease to its source of origin. Lice, worms, and other parasites that infect the pigs are readily conveyed from one to another.

When selecting pigs from a litter, for delivery after weaning at correct age, secure the strongest and best. They will repay the extra cost of two or three shillings per head and prove to be good buying. The same may be said of purchasing stock already weaned and making good progress. Never buy pigs manifestly diseased or with abscess formation, ruptures, piles, or open and suppurating wounds. It is wise to have the stock or dairy inspector have a look at the pigs you intend purchasing in order to have an additional safeguard. It is best to avoid purchasing pigs which are in poor, emaciated condition or are stunted in growth and which give evidence of unthriftiness. Avoid purchasing where the pigs are crowded together in a small and possibly a badly lighted pen, for some sellers are so unscrupulous that they will pack a few ruptured or unhealthy pigs in among a lot of better-class stock in order to reap a benefit of the few extra shillings which better pigs would, in any case, realise.

If there is the slightest doubt about the transaction throw the responsibility on the auctioneer or the vendor and have them explain why certain diseased pigs were sold by them. These are all matters of commercial interest to farmers, especially those who wholly or partly depend on the purchase of store pigs for finishing. Store pigs are those between approximately two and a-half and four months of age, midway between weaner and "slip" stage and light porkers (four to four and a-half months).—E. J. SHELTON, Senior Instructor in Pig Raising.

State Schools' Eisteddfod.

The Queensland State Schools' Eisteddfod will be held at the City Hall, Brisbane, from 13th August to 18th August. The purpose of the Eisteddfod is to demonstrate the high standard of musical performance attainable in Queensland schools, and to allow teachers and pupils the benefits of comparison and criticism by an eminent musical adjudicator.

Special railway fares have been arranged for country competitors. For children a special rate at one-quarter the regular adult excursion fare will be charged. Conductors and pianists will be charged one-half the adult excursion fare. Parents and other grown-ups travelling to the Eisteddfod will be charged at the special rates prevailing for Exhibition Week.

Visiting choirs will be billeted with children attending Brisbane schools, on the basis of one or two visitors to each home, so that children from country schools who are members of a school choir will be saved the expense of accommodation.

It is intended to make the Eisteddfod programme a very attractive one, and the whole week should be enjoyable to those who make the journey. Furthermore, the reduced fares (both for children and adults) should make the time a favourable one for a holiday visit to Brisbane.

The farmers' support of the venture should do much to ensure its success.

Trees on the Farm.

The advantages of windbreaks on a farm are:—

Firstly, they break the mechanical force of the wind, thus preventing undue damage to orchards by breaking off limbs, blossoms, and fruits. The production of blossoms, fertilization, and maturing of fruits cannot be satisfactorily carried out in places open to the full force of high and frequent winds. Further, the lodging and damage by wind of other farm crops, such as maize, &c., can be prevented largely by suitable shelter belts.

Secondly, they provide a very necessary shelter for stock of all descriptions. To see a mob of cows or sheep huddled beneath a tree during the bitter winds of winter is to realise that the health and well-being of stock demand the provision of some efficient shelter. Too much food material is wasted in "warming the wind," or in meeting the increased demands of an exposed body. Sheltered animals require less food. Stock-owners agree that mortality among sheep, particularly during lambing and shearing seasons, would be considerably lessened if good shelter were available. Animals clearly demonstrate their need for shelter, and if the stock-owner were to provide it he would add considerably to his profit.

Thirdly, windbreaks prevent soil erosion and removal of topsoil due to unrestricted wind action. This is particularly in evidence where light soil predominates and little natural cover exists. The effects of dust storms are mitigated.

Fourthly, they reduce evaporation and help to conserve the soil moisture. Where the wind is unrestricted, evaporation goes on at a rapid rate. In the immediate lee of a windbreak evaporation is reduced by as much as 60 per cent., and actually at one point it has been shown, under ideal conditions, to reduce evaporation by 70 per cent. The protective zone of a break varies with local conditions, but, generally speaking, it shelters an area equal in width to six to fifteen times the height of the trees. A narrow strip is also protected on the windward side. In the protected zone the average reduction in evaporation falls round about 30 per cent., the moisture retained in the soil being available for crop needs.

The actual result of a breakwind in reducing evaporation is therefore equivalent to a fairly large increase in rainfall. Areas unsuited for certain crops by reason of an insufficient rainfall might, therefore, be made to grow them profitably if protected by efficient breaks.

Fifthly, when planted near dwellings, they add greatly to the personal comfort of the farmer by protecting the home buildings from the extremes of winter cold and summer heat, and from dust storms. The home is made an infinitely more pleasant place to live in if the owner will go to the small amount of trouble entailed in planting a belt of trees.

Lastly, when planted on a big scale they can be made a source of timber and fuel supply for farm needs, and even assume the character of a tree plantation.

The claims of the windbreak can hardly be ignored by the orchardist, farmer, or pastoralist.

Farming's Inevitable Gluts.

The history of agricultural effort the world over has been an inevitable series of booms and serious depressions. Is it possible to "iron out" these high and low peaks? Some of the best brains of the world have applied themselves to the problem, and they turn to international control as a remedy. Yet the brilliant young English economist, H. V. Hodson, whose book, "Economics in a Changing World," is already almost a classic, speaks thus of the quota and other restrictive remedies: "As a nostrum for the world's economic ills they rest on the profound fallacy that the paradox of poverty in the midst of abundance has its sole solution in perpetuating poverty by abolishing the abundance."

Yet the same clear thinker has to admit that primary production does tend to increase faster than the effective demand, and that this lends an element of instability to the whole business system. "The reason is," he says, "that primary production increases in efficiency with the aid of mechanical and chemical science, at least as rapidly as the total wealth of the world. On the other hand, as real income increases, a diminishing proportion of it is devoted to primary products, and a rising proportion to the higher stages of manufacture, and to services of all kinds. Thus, until the least efficient producers are squeezed out, primary prices have a perpetual tendency to fall, periodically, to quite unremunerative levels."

These extracts, only a trifling proportion of the quantity of informative and thought-provoking material which has come under the writer's notice, are reproduced to show how the problem is vaster than is possible of final and complete handling by any board representing the producers of an industry. Governments have taken a hand in trade policy all over the world, and only Governments can deal with

Bacteria in Milk and Cream—Sources of Contamination.

Bacteria thrive in milk, and every precaution must be taken to prevent their entry. This susceptibility, and the fact that bacteria are everywhere, makes the production of a sterile milk by the farmer impossible, but knowledge and avoidance of the chief causes of contamination should enable him to market a very satisfactory product, writes an officer of the Biological Branch of the New South Wales Department of Agriculture.

The Cow.—Milk is contaminated before it leaves the healthy cow. There are always some bacteria living in the milk ducts, &c., but luckily these forms are rarely numerous and seldom cause a noticeable change in milk, even after standing for many days. However, should the udder be in a diseased condition the milk may be abnormal before it leaves the cow. Ropy or curdled milk is often drawn under these circumstances.

Materials adhering to the outside of the teats and udder frequently bring about important contamination. When the cows rest at night time this portion of their body comes into direct contact with the ground and becomes smeared with droppings, &c., which contain extremely high numbers of bacteria. From here they readily gain entry to the milk. A similar process brings about contamination from the tail, which is always in an insanitary condition. Particularly during the spring and summer months, the fly pest causes the tail to be in constant motion, and unless more than ordinary care is observed, the tail will find entry to the bucket during hand-milking.

Contamination from the Air.—Varying amounts of contamination take place from the air in and around the milking bails. Some yards are dusty, and unless the cows are all in a contented mood, a certain amount of milling takes place and results in flying dust. Such dust has invariably been fouled and adds large numbers of bacteria to the milk. Again, the practice of feeding hay or silage to the cows while they are being milked is sometimes followed. Yeasts, moulds, and bacteria gain entrance to the milk from this source.

The Careless Milker.—In some instances carelessness on the part of the milker results in contamination. Unwashed hands are always insanitary, while hands which may have been thoroughly clean at the outset soon become dirty, as a result of contact with the animal. Some people have the habit of "wet" milking, and this is much more insanitary than the "dry" method.

Water as a Source of Contamination.—On several occasions faults in milk and cream have been traced to stagnant water. While the popular belief that the drinking of such water is, in itself, the cause of subsequent deterioration is unfounded, the fact remains that bacteria from such water often gain indirect entry to the milk. Mostly the cattle wade in a polluted swamp searching for watercouch, or they may even have to cross a stagnant creek in being driven to the milking yard. The body, including the teats and udder, is fouled in this manner and the bacteria are later added to the milk while it is being drawn.

The biological quality of the water used for washing down the udder is also of importance. When cow after cow is washed with the same cloth and water from the same pail the water becomes more and more insanitary and a source of pollution to the milk. Sometimes the water is unsuitable at the outset, being taken from iron tanks in which manurial dust, blown from the yard to the roof and washed down the spouting, has been allowed to accumulate for months.

Unsuitable and Dirty Utensils.—By far the greatest number of bacteria are derived from the utensils. Kerosene or petrol tins have a groove at the bottom from which it is impossible to remove all traces of milk. This material supports the development of large numbers of bacteria which attack the fresh milk immediately it is poured into the can.

Concerning the value of a milking machine on the farm, there are two very definite opinions, and one of the strongest arguments used by those who condemn the machine is the irregular quality of the milk drawn through it. Naturally there are many places in which bacteria may become lodged in the mechanism. In earlier patents, communication of condensed water or trapped milk from the air line to the milk line frequently occurred, and even with recent models if the units are not conscientiously dismantled and cleansed, serious contamination of the milk soon results.

Next to the milking machine the separator may be classed as the most likely source of contamination. The discs are the chief trouble. Much casein and other slime becomes settled between the individual discs during the skimming process. The removal of this material necessitates extreme thoroughness of washing, with the result that some of it is frequently left behind and breeds up an undesirable

inoculum for the next separation. Even when carefully washed the discs are often left so close together that they fail to dry, and in the droplets of water between them bacteria, and often rust spots, develop.

Cloths.—In many dairies cloths find favour as an aid in the washing up process; and in many dairies cloths are a source of contamination which results in the rapid deterioration of the quality of milk and cream. Cloths retain the fat, casein, &c., and unless carefully spread out take a long while to dry. Under such conditions they rapidly become foul-smelling and are a source from which countless micro-organisms gain entry to the milk. If kept sanitary by careful washing, rinsing, boiling, and quick drying, a cloth is probably less dangerous than a brush, for in the latter it is practically impossible to free the base of the bristles from greasy materials.

Facts about Animals.

The Creator gave various animals special prehensile organs and attributes to enable them to exist in the same environment. Observation makes some of these special features apparent and it would be well for every young farmer to note them in the animals he has to feed.

Many of them, however, have not been noticed by the average stockmen, and are worth mentioning. For instance, the sheep has a cleft upper lip, that it may spread the sections apart and get its teeth close to the ground for short herbage cropping.

The cow takes its forage in a different fashion. Her tongue is rough like a rasp, and with it she gathers between her eight incisor teeth of the lower jaw and the cartilaginous pad of her upper incisors, locks or tufts of grass which she then wrenches and cuts off for mastication with her molar or grinding teeth. In a time of drought, when grass is dry and loose in the ground, the roots, with some soil attached, commonly enter the cow's mouth with each tuft of grass; but the cow discards the soil and it falls from one side of her mouth. At such times one will find little heaps of this discarded soil everywhere on the pasture. This is not done by the pasturing horse. The rigid teeth of the upper and lower jaw seize a tuft of grass and cut it off for chewing. If soil comes with the grass it is swallowed, and so much "dirt" or sand may be thus taken in as to cause indigestion or colic, which often proves fatal.

The horse's tongue is long, slim, and smooth, instead of being rasp-like, and the ridges of the horse's hard palate are also smooth, as is the lining membrane of the cheeks. Look into the cow's mouth and you will see that some long, teat-like objects (papillæ) project from the inner surface of the cheeks, especially on a level with the grinding surface of the molar teeth, and the ridges of the palate are also rough, with saw-like edges pointing backward.

The papillæ and points of the palate ridges or "bars," together with the roughness of the tongue, are intended to help the cow retain the feed in her mouth while chewing her cud. A farmer once wrote us that when his cow was sick he looked in her mouth, saw the papillæ mentioned, thought they were warts, cut them off, and reported that the cow was not a bit better after the operation. It is well to know the facts about such anatomical features.

That is also true regarding the teeth. The incisor teeth of the cow normally or naturally are somewhat loose in their sockets, but the looseness has often been blamed to the eating of silage, by the uninformed stockman. So has the early wearing away of the cutting parts of the incisor teeth. That occurs when the cow is ageing, so that when she is twelve years old, and sometimes when she is younger, one may find little rounded stubs, like collar buttons, projecting from the gums, instead of large, broad, shovel-shaped teeth. The broad parts quickly wear off and the slim necks remain. In the horse, however, the incisors, above and below, last the animal until it is twenty or more years old.

The hog "goes" the cow and horse "one better" when on pasture. It roots below the surface to obtain feed, grubs, minerals, &c., and, therefore, is fitted with a special bone in its snout and a ring of strong gristle as well, to make rooting possible; and speaking of extra bones, you will find two of them in the cow's heart, but none in that of the horse. A moment of thought will enable the reader to understand, with these facts about domestic animals, why the giraffe has such a long neck, the elephant its trunk, the ant-eater its elongated proboscis, the carnivorous or flesh-eating animals their fangs and bone-crushing molars, and the feline animals their claws, which have special muscles to keep them hidden or spring them into savage action.—"Hoard's Dairyman."

The Imperial Sentiment.

Unfortunately the strongly expressed feelings of the British farmer in regard to disastrous competition from the Dominions, and the latter's resentment of proposals for regulation, have led to a feeling of constraint, which is not going to improve Imperial relations. This factor is realised in England, and it is good to find so important a journal as the London "Times" reproducing on its leading-article page, in issues just to hand, a series of articles on the whole situation, written with special regard to the viewpoint of the overseas countries of the Empire. These are lengthy contributions, very faithfully covering all aspects, and the opening paragraph will be read by our own producers with the greatest interest:—

"What is prudence in the conduct of every private family can scarce be fault in that of a great Kingdom. If a foreign country can supply us with a commodity cheaper than we can ourselves make it, better buy it of them with some part of the produce of our own industry employed in a way in which we have some advantage. Adam Smith in 1776," continues the writer, "gave this exhortation which seems to be the veriest commonplace. Yet in December, 1933, the wholesale price of butter was 69s. per cwt. in London, 184s. in Berlin and Belgium, and 238s. per cwt. in Paris. These prices give some indication of the extent to which the commercial policy of nations has departed from the commonsense of the economists."

The agrarian policies of Continental countries is explained, some of the illuminating facts quoted being that Switzerland has, through its changed policy, reduced butter imports from 200,000 cwt. in 1931, to 10,000 cwt. last year. Although in 1928 the Continent was importing six million cwt. of beef per annum, this has been reduced to four million cwt., and the process involved increasing pressure on the only open market, Britain, and, as the writer remarks, "until the Ottawa quota began to operate, the pressure of superabundant supplies was having a disastrous effect upon the price of domestic beef."

Britain's increasing ventures into protection for its farmers is described, wheat in Britain, for instance, being twice the price of world parity, while the encouragement of the beet-growing industry results in sugar having to be produced at a quite uneconomic price, compared with that in the normal sugar-producing countries. "If the present state of affairs continues," comments the writer, "we shall be forced to contemplate the wholly unsatisfactory spectacle of the low-cost producers of Denmark, New Zealand and Canada or Australia, being forced to abandon their farms because Governments of the industrial countries are determined to make production remunerative to their own sub-marginal producers. This is a challenge to economic sanity."

The last point leads up to the question of what the British Government will regard as a "remunerative" price, and for whom? The reasonably efficient, or the inefficient farmer? The explanation of the new agrarian policy of the British Government, as given by this obviously well-informed writer, is that it is determined to use the bargaining-power of its great market for food-stuffs, to promote export trade in manufactures, combined with the desire to secure prosperity for the Home agriculturalist. It is the harmonising of these factors, with the natural desire of the Dominions to expand and develop, which is the problem of to-day.—"The New Zealand Farmer."

How to Pit Potatoes.

A level piece of land, so situated as to ensure drainage, should be selected for the pitting of potatoes for winter storage. Two poles or saplings are placed on the surface, parallel to one another and 4 feet apart, and the potatoes are emptied in between these so as to form a well-ridged heap. The potatoes are then covered with a thatch of straw or other suitable material, and this again is covered with sods of earth. It is important that the sodding should be done from the ground upwards (as in shingling a roof). When completed, the whole is beaten well down with the back of a spade, and a drain is cut round the put to run off the water in case of rain.

Potatoes for pitting should be as dry as possible. If weather permits, it is well to let a fortnight or so elapse before earthing up—that is, to leave the potatoes with only their straw covering so that sweated moisture may be carried out. For a small pit (say 1 ton) the best shape is a cone.

It should be remembered that unnecessary exposure causes a deterioration in quality. Light causes a greening of the skin, and even a partial exposure may cause a yellowing of the flesh.

Colic in Horses.

It is extremely difficult to differentiate between the various gastric and intestinal affections in the horse, and most complaints seem to be placed under the heading of colic. The name is given to a train of symptoms which horses show when they have pain in the abdomen. In the horse two forms of colic are distinguished, namely, spasmodic and flatulent—

In spasmodic colic the pain is not continuous, but there are intervals of ease between the spasms, during which the animal appears quite well, until another spasm suddenly occurs. The animal is generally violent, paws, stamps, kicks at its belly, lies or throws itself down, rolls, crouches in the loins when walking, stretches itself out, looks round at the sides, and sweats either in patches or all over. The pulse is fast, the breathing hurried and distressed, and the mucous membrane of the eye is red, but the temperature remains normal. Between spasms the animal appears quite well, and will start feeding if allowed. As the attack progresses, the pains get more frequent and longer, and the intervals free from pain shorter. Constipation is a symptom as a rule.

The animal should be walked about, and on no account permitted to lie down or roll. The following drench should be given at once:—1 drachm oil of peppermint, 2 ounces aromatic spirits of ammonia, 1 pint linseed oil. Keep well shaken, and drench slowly.

If relief is not obtained in an hour, repeat the mixture, substituting thin gruel for the linseed oil. This may be repeated till three doses have been given, at intervals of an hour. Apply hot fomentations to the abdomen for periods of half an hour at a time, keeping the temperature of the water so high that the hand cannot be kept in it—half-cold fomentations are quite useless—or mustard mixed sloppy in a basin with vinegar may be rubbed over the belly. Give copious enemas every hour. If, in spite of this treatment, the animal is still not relieved, give the following drench, repeating if necessary every three hours:—1 ounce chloral hydrate, 1 pint thin gruel.

Flatulent colic is due to fermentation of the food in the bowels, which become distended by the resultant gases. The belly is inflated, giving the animal an unnaturally round appearance, and the pain is continuous, though not so violent as in the spasmodic variety. The animal does not throw itself about so much, but appears somewhat sleepy, though uneasy and fidgety, scraping, wandering slowly round, attempting to lie down, but afraid to do so.

The following drench should be given at once:—2 ounces oil of turpentine, 2 ounces aromatic spirits of ammonia, 1½ pints linseed oil. Shake the drench very frequently whilst giving.

Walk about and give enemas and fomentations as in spasmodic colic. If the pain is not relieved in two hours, give an ounce of oil of turpentine in a pint of thin gruel, and repeat again in two hours if necessary. If still not relieved, give the chloral hydrate as in spasmodic colic. As an after treatment, when the pain has subsided, feed the animal on bran mashes for twenty-four hours. It is also best not to work the horse for two or three days.

In drenching, if the animal struggles, or attempts to cough, immediately lower the head. A portion of the drench may be wasted, but unless this is done the fluid will be likely to pass down the windpipe, and the horse die of pneumonia.—A. and P. Notes, New South Wales, Department of Agriculture.

Kikuyu Grass Sets Seed.

The first record of Kikuyu grass (*Pennisetum clandestinum* Chiov) forming seed in Australia comes from the Comboyne district, New South Wales. Writing to the New South Wales Department of Agriculture on 26th March last, Mr. Les. Pfeiffer stated that for several years past on his property this grass had formed the female portions of the flowers, but that this year a small patch was bearing complete flowers and setting seed. On 16th April he forwarded specimens of immature flowers and also mature ones carrying seed.

The Comboyne plateau is 1,900 feet above sea-level, and the average annual rainfall over a period of eight years is 63.80 inches.

Kikuyu grass was first grown in Australia from seed obtained by us from the Belgian Congo in 1919. This seed was planted at the Botanic Gardens, Sydney, and sufficient cuttings were thereby obtain to enable a plot to be planted at Hawkesbury Agricultural College, Richmond. Most of the Kikuyu grass now growing in this and other States was distributed from these two centres.

Points for Pig Raisers.

The ambition of the pig raiser should run along something of the following lines:—

More pigs per litter and more weight for age.

Better and healthier pigs and more protection from disease.

Lower mortality and better control of disease.

Better proportioned and more attractive carcasses and more profitable returns.

* * * * * *

Improve the condition and increase the stamina of your pigs by using properly balanced rations, by regularity of feeding, and by keeping the pigs under strictly sanitary conditions.

* * * * * *

The liberal use of minerals, and, where necessary, of the commoner drugs, will do much to ward off disease and enable pig raising to be carried on with a greater margin of profit. Properly compounded mineral mixtures are invaluable for developing bodily strength in the animals and in generally improving the health of breeding and young stock.

* * * * * *

What should a litter of pigs weigh at three weeks of age? A well known manufacturer of commercial pig meals in Great Britain advertises that under efficient management and with properly balanced foods a fair average would be 7.5 pigs at 10.5 lb. each, equally 78.75 lb. per litter. The firm referred to claims that by the use of their food it is quite possible to increase this average to 8.39 pigs at 12.4 lb., equally 104.8 lb. at three weeks of age. They like their customers to regularly weigh their pigs.

Deficiency Disease in Cows.

Referring in a recent report to cases of deficiency disease in dairy cows on the Central New South Wales Coast, the Chief Veterinary Surgeon of the New South Wales Department of Agriculture draws attention as follows to the value of a sterilised bonemeal lick:—

"There appears to be a tendency rather to use complicated licks for cattle suffering from phosphorus deficiency when in reality bonemeal or dicalcic phosphate is the only thing required in addition to common salt. Alternatively, of course, the necessary mineral matter may be provided to the cattle through using artificial fertilizers on the pastures, and the benefit derived would be very greatly increased were the farms more markedly subdivided. In connection with the use of steriilsed bonemeal and the value to be derived from its use, reports on investigations recently carried out in Florida are to hand. These reports stress the point that in very deficient country regular access to bonemeal is required over a prolonged period if cattle are to be expected to produce satisfactorily and to breed at the same time."

Horse Market Revival—Stallion Parades.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock, M.L.A.) has expressed his satisfaction at the revival in horse sales in many country centres, as indicated in recent press reports. The Minister also referred to the Stallions Registration Acts, which have for their primary object the elimination of the unsuitable and unsound horses of all breeds, and expressed the opinion that this desirable objective could only be achieved with the co-operation of breeders and owners. Mr. Bulcock emphasised the necessity for owners complying with the legislative provisions, which insist on examination and registration of stallions.

Arrangements are now in progress for the annual examination of stallions, which will be carried out during the next two or three months at various centres appointed for that purpose, and the attention of owners is directed to parades advertised in metropolitan and district newspapers. Strict compliance with the provisions, which prescribe compulsory registration, is to be enforced in future.

At any sales held intending purchasers of stallions should insist, for their own protection, on the production of a certificate of registration of the animal under the Stallions Registration Acts, as uncertificated horses are prohibited from being used for either public or private service.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

PLAYING WITH BABIES.

This article appeared in the newspapers of New Zealand a few years back.

A RECENT spectacle of a bright, intelligent baby being treated as a plaything by every member of the family concerned leads us to touch once again on this subject.

Play is a natural instinct which man has in common with the lower animals. It seems that the higher an animal comes in the scale of creation the more highly developed is its instinct for play. When we come to the domestic animals we see playfulness developing in proportion to the intelligence, and in the apes and monkeys playfulness is retained throughout life.

It is right and natural that baby should play—something is radically wrong if he does not early show this instinct—but

How Does He Play?

Kicking exercise is the baby's earliest play. From it he derives numerous sensations which give him pleasure. Later this leads on to the discovery of his first and best playthings—his own fingers and toes—best because in addition to their fascinating habit of unexpectedly appearing and disappearing, he derives twofold pleasure from playing with them; that of touching and of being touched. Then he comes into the realms of playthings apart from himself, though not necessarily rattles or playthings proper. Every object within his reach is a potential plaything, and life consists of one great game—the adventure of satisfying curiosity.

This sort of play is utterly satisfying to the unspoilt child, besides being satisfactory and safe. Baby can play it in his own time and at his own pace. When he is tired he can stop; if he goes on a little too long Nature steps in and he sleeps till his nervous energy is restored. His developing faculties are healthily stimulated without the slightest danger of over-stimulation of the delicate nervous system.

The Wrong Sort of Play.

How different is this from the case when the baby is *played with*. Then stimulation is applied in *our* time, at *our* pace, and the result is inevitably a certain degree of over-stimulation, unless the process is kept within strict limits.

Just watch a baby responding to prolonged playing of this kind. The eager, responsive type of child quickly reacts, and his delicious

gurgles and chuckles charm us. If a very little of this is allowed to go a very long way no harm is done, but the first signs of wandering attention or fretfulness are certain signs of fatigue and should be the signal to *stop*. Too often, unfortunately, they are taken as the signal for more strenuous efforts at so-called amusement, to which the baby again responds, though after a time there is probably a slightly hysterical note in his laughter and gleeful shouts. Presently everyone is tired, yet it may strike no one that the baby is fretful and will not sleep for the simple reason that he is nervously exhausted.

Put Yourself in the Baby's Place.

Just imagine one's feelings if a creature of ten times one's size and mental capacity (though not necessarily possessed of intelligence to match) insisted on prolonging certain diverting antics beyond one's powers of spontaneous response! It does not require much effort of the imagination to see that this sort of thing carried on over a long period may mean wrecking of the nervous system with some temperaments. *The bald fact of the matter is that adults play with babies for their own amusement, not the babies' pleasure.*

Someone has suggested that a baby affects many women much as a mechanical toy affects many men. "Give a child a clockwork engine and father won't be able to leave it alone. Give him also a few trucks, a toy railway signal, and 6 feet of tin track and he will neglect his business!" So with many a woman—give her a baby and she can't leave it alone. All unknowingly she satisfies her own play instinct at the expense of the child.

Mothering.

One does not mean to imply for a moment that the baby should receive no attention. Babies allowed to grow up without a certain amount of handling and loving attention become pale, flabby, and listless.

What one does mean is that the greatest part of the direct stimulation should come to the child in the simplest way along with tender and skilful "mothering" and "handling," at feeding and bathing times chiefly. The sum of exercise and stimulation obtained in this way during the course of the day is very considerable and quite sufficient for the young or easily stimulated baby.

A judicious amount of more direct "playing with" may be allowable, according to the type of child, so long as the caution indicated in a previous paragraph is observed. In addition, remember that there is one time when a baby needs no stimulation whatever, and that is just after a meal. Yet, by some contrariness, this is just the time when it is often given, the poor little mite being jogged and patted and talked to.

Troublesome digestive disturbance may be due to this cause, and this alone. A persistent habit of vomiting may be set up which affects progress and requires a prolonged period of treatment for cure. We have many such cases admitted to the Karitane Hospitals, some of whom need practical isolation for a time so over-stimulated are they.

To sum up, the less babies are deliberately played with the better, and there should be no playing near meal times or within an hour or so of bedtime. Injudicious playing with infants makes them nervy and cross, disturbs their sleep, disturbs their digestion, and may cause

undesirable conditions in other respects. If one must play with the baby let the play be of very short duration, stopping short of the first sign of fatigue, gentle and quiet, not boisterous, and not with a whole gallery of spectators looking on and perhaps joining in. The baby's early play should be mainly with his first playmate—himself and his own fingers and toes.

IN THE FARM KITCHEN

BREAD-MAKING.

A GOOD bread-making flour is essential; some flours make excellent cakes and puddings, but are not good for bread-making. This is because bread requires a flour containing plenty of gluten. Some varieties of wheat make a flour low in gluten content, and these are not suitable for bread.

Yeast works best at temperatures of from 77 to 95 deg. Fahr. Keep the dough near the stove in cold weather and during heat waves put in cool place or it will rise too quickly and give a loaf that is too porous. Yeast will not work below 30 deg. Fahr., and is killed at 212 deg. Fahr. Salt retards the action of the yeast slightly; it should not be added till the dough is working well.

A little sugar improves the loaf. It prevents the crust from being too hard. The water or milk used to mix the bread with should be scalded and then allowed to cool down to lukewarm—about 103 deg. Fahr. Milk makes a very nutritious loaf with white crumb and rich crust. If all milk cannot be used try half milk and half water.

Cook for one hour: start with a hot fire (400 deg.) and decrease the temperature after a while. The cooking drives off the carbon dioxide and kills the yeast plant, so that it does not rise any more.

Troubles in Bread-making.

Over kneaded dough is sticky and will not rise; under-kneaded dough is streaky and the bread will contain lumps of dough that have not been worked out.

Too much flour gives too stiff a dough, rises very slowly, and the flavour will be poor.

Too long a rising will give a porous loaf with poor flavour. If the rising continues too long, the bread will settle over the side of the tin or become sour.

Too cool an oven will make the bread rise too long and it will be too porous.

"Rope" is caused by a bacillus; it often appears in hot, damp weather. When the bread is about a day old the crumb goes stringy or ropey and the flavour is so disagreeable that it is quite unfit for use. This disease is hard to get rid of. The treatment is to sterilise all utensils, and add vinegar equal to 2 per cent. (one tablespoon vinegar to 1½ lb. flour) of the flour used, for all the remaining flour you have.

Recipes for Yeast.

Yeast is a microscopic plant, which, when given food, air, warmth, and moisture multiplies very rapidly and produces carbon dioxide; this stretches the gluten and the dough rises. There are three main kinds of yeast. Compressed yeast comes in small damp cakes; it is ready to work immediately it is given the food and moisture, &c., and will keep in good condition two or three days. Dry yeast is a mass of yeast plants dried and mixed with some kind of meal. Although alive, it is inactive, and even after it has been given the food, warmth, and moisture it takes some hours to start working well. It is sold in tins and will keep some months. Liquid yeast may be made at home as follows:—

Cream of Tartar Yeast.—Put 1 heaped tablespoon of hops in a saucepan with 4 cups water and boil twenty to thirty minutes. Put 1 tablespoon sugar, 1 teaspoon cream of tartar into a basin, strain the boiling hop water on to it and stir; when cold mix with 3 tablespoons flour and add 1 tablespoon old yeast. Put in basin, cover with plate, and keep in a warm place near the stove for twelve to eighteen hours. It is then ready for use. Stand in a cool place, and it will keep for a week or ten days in cool weather. Use three-quarters of a pint of this to make 3 to 5 lb. bread.

Potato Yeast.—Materials: Three potatoes, two pints boiling water, half cup flour, one-quarter teaspoon ginger, one tablespoon sugar, one and a-half tablespoons salt, half cup old yeast. Peel the potatoes, cut small, cook in the boiling water, mash potatoes. Mix next four ingredients and pour over them the potatoes and water in which they have been cooked. When lukewarm add old yeast. Keep lukewarm for twenty-four hours, put into basin, cover, and keep in cool place. Will keep two weeks.

Neither of these yeasts requires bottling or cooking.

TOMATO SOUP.

Materials—2 lb. tomatoes; 2 onions; 2 slices bacon; 1 tablespoonful dripping; 1 tablespoonful sago soaked in 1 cup of water; 1 teaspoonful sugar; 1 teaspoonful salt; 1 pint water; 3 pints stock; pepper.

Utensils—Bowl; knife; saucepan; basin; sieve; wooden spoon.

Method—

1. Wash sago in three waters; soak it in 1 cup of water; wash, peel, and cut up tomatoes and onions.
2. Cut up bacon into small pieces; put dripping and bacon into a saucepan; fry for 3 minutes.
3. Add cut-up vegetables, salt, and sugar; fry for 10 minutes, stirring constantly.
4. Add water; simmer for 1 hour.
5. Strain soup into a bowl, rubbing the thick part through the sieve with a wooden spoon.
6. Return the strained liquid to the saucepan; add stock and soaked sago; boil till the sago is clear; season with pepper and salt as required.

Notes—

1. Tapioca may be used instead of sago.
2. This soup may be made without stock, using 2 quarts of water instead of 1 pint water and 3 pints stock.
3. It may be made with milk, using 3 pints water and 1 pint milk; in this case ½ teaspoonful of carbonate of soda and the milk are added about 10 minutes before the soup is served.
4. The bacon may be omitted.

FRUIT PIE.

Materials—For pastry: 6 oz. flour; 3 oz. dripping; ½ teaspoonful baking-powder; ½ gill water; salt; 1 dessertspoonful milk for brushing over; 1 teaspoonful sugar for sprinkling over the finished pie. For filling: 1 lb. fruit; water and sugar as required.

Utensils—Pie dish; knife; basin; bowl; pastry board; rolling-pin; teaspoon; fork; brush.

Method—

1. Fill a pie dish with prepared fruit, piling the fruit high in the middle, and adding sufficient water or juice to come to about 1 inch below the inner edge of the dish.
2. Sift flour, baking-powder, and salt into a bowl.
3. Rub dripping into the flour with the tips of the fingers; mix into a dough, adding the water slowly.
4. Turn out on a floured board; knead lightly.
5. Roll out to the thickness of ¼ inch; cut a strip about 1 inch wide, and long enough to cover the edge of the dish; wet the edge, put the strip of pastry on it; wet the upper surface of the pastry.
6. Cover the fruit and the strip of pastry with the remainder of the pastry; cut round the outside edge, working the knife downwards.
7. Ornament the edge with a spoon or fork; decorate with leaves cut out of scraps of pastry.
8. Brush over with milk or water; sprinkle with sugar.
9. Bake in a moderate oven until the pastry is a golden brown colour; this will take at least 30 minutes.

To prepare the fruit—

1. Apples, pears, quinces, and other large firm fruit must be peeled, cored, quartered, and stewed with sugar before they are put into the pie dish.

2. Berries and small fruit should be wiped; they should not be washed. Sugar must be added, the quantity depending on the kind and ripeness of the fruit.
3. Dried fruit should be washed and soaked for 12 hours; sugar and part of the water in which the fruit has been soaked should be added to it in the pie dish.
4. Fruit preserved in water is ready for putting into the pie dish; it may be necessary to keep back part of the juice; the amount of sugar to be added depends on the tartness of the fruit.
5. Tinned fruit preserved in syrup should not require sugar.

DROP SCONES.

Materials—½ lb. flour; 1 teaspoonful carbonate of soda; ½ teaspoonful salt; 2 gills sour milk or butter milk; 1 dessertspoonful sugar.

Utensils—Sieve; bowl; wooden spoon; cup; greased paper; frying-pan.

Method—

Sift flour, carbonate of soda, and salt into a bowl.
2. Add the sugar; mix well; add sour milk or butter milk.
3. Beat the mixture until it is smooth.
4. Rub greased paper over the bottom of a hot frying-pan.
5. Drop small tablespoonfuls of the mixture separately on the hot greased pan.
6. Cook until bubbles appear on the upper side; turn; cook under side until it is golden brown.

Note—If sour milk or butter milk is not obtainable, sweet milk, to which 1 teaspoonful of cream of tartar or ½ teaspoonful tartaric acid has been added, may be used.

STEAK AND KIDNEY PIE—FLAKY PASTRY.

Materials—For filling: 1 lb. steak; 2 sheep's kidneys or ½ ox kidney; 1 slice bacon; 1 tablespoonful flour; 1 teaspoonful salt; ¼ teaspoonful pepper; 1 teaspoonful chopped onion; 1 cup water. For pastry: 6 oz. flour; ½ teaspoonful baking-powder; 1 teaspoonful butter; ½ gill water; 3 oz. lard or dripping.

Utensils—Board; knife; 2 pie dishes; bowl; sieve; rolling-pin; brush.

Method—

1. Cut bacon and kidneys into pieces; slice the meat into strips or squares about ½ an inch thick.
2. Roll all the pieces in flour, pepper, and salt; arrange them in a pie dish, placing a piece of kidney, a piece of kidney suet, and a small piece of bacon on each slice of steak; sprinkle each layer with minced onion.
3. Add water; cover with a second pie dish; cook in a moderate oven for 30 minutes; cover with flaky pastry.

For flaky pastry:

4. Sift flour, baking-powder, and salt into a bowl.
5. Rub in butter with the tips of the fingers; add water slowly; work into a dough.
6. Turn out on a floured board; knead lightly; roll out into a square.
7. Cover the surface with one-third of the lard or dripping broken up into small pieces.
8. Fold in three; place with the open end towards you; roll out, working only from you.
9. Repeat 7 and 8 twice; fold again in three; roll out into the shape of the pie dish.
10. Cut a strip of pastry about ½ an inch wide; moisten the edge of the pie dish; cover the moistened edge with the strip of pastry.
11. Moisten the strip of pastry; place the remainder of the pastry over the pie dish; pressing the edge close to the moistened strip.
12. Trim the edges, cutting with a sharp knife downwards close to the rim of the dish.
13. Make a hole in the middle of the pie; decorate with leaves cut out of the scraps of pastry trimmed from the sides.
14. Brush over with milk or beaten egg; bake in a hot oven for 30 minutes.

PANCAKES.

Materials—2 oz. flour; 1 egg; 1 gill milk; pinch of salt; 1 tablespoonful sugar; 1 lemon.

Utensils—Bowl; sieve; cup; basin; fork; whisk; frying-pan; knife; brown paper; lemon-squeezer; d'oyley; dish.

Method—

1. Sift flour and salt into a bowl.
2. Add beaten yolk of egg and milk; mix well.
3. When smooth add the stiffly-beaten white of egg.
4. Heat dripping in a frying-pan; pour in enough batter to make a very thin layer in the pan.
5. Cook till slightly browned on the lower side; turn quickly; cook for 1 minute on the other side.
6. Lift out; drain on brown paper; roll up; sprinkle with lemon juice and sugar; serve on a d'oyley on a hot dish.

Note—Pancakes may be served piled in layers with jam between each layer; the top pancake is sprinkled with sugar; portions are cut in wedges for serving.

ABERDEEN SAUSAGE.

Materials—1 lb. steak; 2 oz. bacon; ½ cup white bread crubs; 1 tablespoonful flour; 1 tablespoonful sauce; 1 egg; pepper and salt to taste; ½ cup brown bread crumbs.

Utensi's—Mincer; knife; bowl; pudding cloth; saucepan.

Method—

1. Mince the steak and bacon.
2. Put meat, bacon, bread crumbs, pepper, salt, and flour into a mixing bowl.
3. Add sauce and egg; mix thoroughly; form into a sausage.
4. Tie securely in a damp cloth.
5. Place in boiling water and boil for 2 hours.

Roll in bread crumbs and serve cold; garnished with parsley.

GERARD STEAK.

Materials—1 lb. topside steak; 1 dessertspoonful mustard; 1 dessertspoonful sugar; 2 tablespoonfuls vinegar; salt and pepper.

Utensils—Baking dish; basin; iron spoon; board; rolling-pin; cup.

Method—

1. Attend to the oven.
2. Place well-beaten steak in baking dish.
3. Mix together mustard, sugar, flour, salt, and pepper to a soft paste with vinegar.
4. Pour over steak and rub in; allow to stand 1 hour; turn and rub.
5. Add 1 cup of cold water.
6. Place in hot oven and cook for 1 to 1½ hours.
7. Service on hot dish with the gravy.

Note—Onions or tomatoes may be sliced and cooked with the meat.

STUFFED STEAK.

Materials—For forcemeat: 1 cup bread crumbs; 1 small onion; 1 dessertspoonful herbs; 1 dessertspoonful dripping; 1 egg or ¼ cup of milk.

For other: 1 lb. steak; 1 dessertspoonful vinegar; salt; pepper; dripping.

Utensils—Knife; bowl; board; rolling-pin; string; frying-pan, and saucepan or baking tin; cup; wooden spoon; dish; gravy boat.

Method—

For seasoning or forcemeat—

1. Peel and cut up onion finely.
2. Put bread crumbs, onion, herbs, dripping, salt and pepper into a basin; mix well; bind with egg or milk.
3. Beat steak with a rolling-pin; place seasoning on steak; roll up tightly and tie into shape; roll in flour, pepper, and salt.

4. Brown in smoking fat; drain on paper.
5. Put into saucepan; add sufficient boiling water to cover the meat; add vinegar; simmer for 2 hours.
6. Remove meat; thicken gravy with blended flour; add salt and pepper to taste.
7. Return meat to the saucepan; bring to boiling point.
8. Serve on a hot dish; pour some gravy over the meat; serve the remainder in a gravy boat.

Notes—

1. Stuffed steak may be baked; directions for roasting or baking should be followed instead of instructions 5 to 9 given above; gravy should be made as for roast beef.
2. By cutting the meat into slices about 4 inches square and half an inch thick, and placing seasoning or a slice of bacon on each piece, beef olives may be made.
3. Savoury chops may be prepared and cooked similarly.

LANDSCAPE GARDENING.

The landscape gardener must possess a good deal of artistic taste, as he deals with the landscape and its improvement. Should alterations be necessary, they must be carried out in as natural a manner as possible, and they must be in unison with the surrounding country. Any existing natural features may be made the most of.

If trees shut out a desirable view, they may with care be removed. Tree thinning also becomes necessary when some are spoiling others. It is better to have one good specimen than several poor ones. When tree planting, the gardener must look forward, and consider their size when maturity is reached.

Broad stretches of lawn may be broken up with shrubs or specimen trees, or beds of flowers. The character of the soil and the situation must be taken into consideration when planting. It is of no use to plant trees or shrubs that are not likely to succeed, and if doubtful ones are included, they must be in positions where they can be easily replaced should they fail. The character of the dwelling must also be taken into consideration.

Vista making is an important part of landscape gardening, and to carry it out the various points of vantage have to be ascertained and their values determined. The outline of the landscape from the various vantage points must be undulating, not straight or unbroken, and though special hues in greenery may be made the most of, they must not be repeated until the eye wearies of them.

Paths should be as few as possible, and each should be made for some definite purpose. They should run in bold but graceful curves, especially when made of gravel.

If summer houses are included they should not stand out aggressively, and they should be covered with creepers as quickly as possible.

FLOWERING SHRUBS.

Lagerstrœmia indica varieties.—There are many beautiful forms of this shrub on the market, and the finest varieties have been raised in Queensland—*L. Matthewsii* and *L. Earesiana;* the colours of both are lilac, but *Matthewsii* is the darker shade. The heads of bloom of both varieties attained a length of about 24 in., and the individual flowers are a couple of inches across. The plant may be grown in any small garden, and the size may be kept at the will of the gardener. Specimens growing in Brisbane range from a few feet high to 20 ft.

The plant stands severe trimming; in fact, it stands the knife so well that it can be grown almost any height by being cut back in July every year, like a grape vine. One of the finest specimens of *L. Matthewsii* can be seen growing on the river side of the Customs House garden. Plants are easily raised from cuttings taken from the previous year's wood and planted during July and August. Also plants well established may be purchased at any of the nurserymen's stores.

Gardenias.—In the earlier days of Brisbane there were few gardens without a gardenia; now they are rarely seen. *G. Thumbergii* is one of the varieties that should be grown. The flowers are pure white, exquisitely scented, and the foliage of all the varieties are a glossy green. These plants are not too fond of pruning, and should be allowed to grow in their own way. *Gardenia florida* is mostly grown

for florists' use, the flowers being perfect in form and not having the heavy perfume of the other varieties. All the gardenia family are subject to scale diseases, but are easily kept clean by occasional sprayings with boiler water that has plenty of soap in solution. The plants never attain any size, so are very useful in small gardens.

Oleander.—In the northern part of the State these plants flourish, and are much admired by visitors from the Southern States and overseas.

The plants attain a fair size if not kept within bounds. In some of our northern towns it is quite common to see plants 20 to 30 ft. high, and of many colours. The plants are grown in Brisbane, but by a few only; yet they grow just as well here as in the North. The smaller growing varieties should be more extensively grown, and the pink "Carnea," white "Madonna," and carmine "Delphine" are all good old varieties.

When growing the plants in small gardens it is necessary from their earliest stages of growth to keep them well headed back, the young wood of the previous year being the flowering wood.

Lantana.—The small varieties of lantana are not in common with the pest scattered all over Queensland, and are very beautiful when trained as hedges or shrubs. The tangerine-coloured variety and the canary-yellow variety are the two usually grown in Southern Queensland. Splendid specimens of these are growing in the Botanic and Museum gardens. The plants flower for nine months of the year, and will grow in almost any soil and will stand fairly hard conditions.

TRANSPLANTING FRUIT TREES.

The transplanting of partially developed fruit trees is seldom attempted on account of the risk of failure and the trouble entailed in endeavouring to retain sufficient fibrous roots to ensure a reasonable prospect of success. Trees up to five or six years old, where subject to the necessary preliminary treatment, can not only be removed without risk of failure, but transported satisfactorily over long distances. It will be recognised that the sustenance of the plant is absorbed by the small or fibrous roots in the immediate vicinity of their terminals, and by inducing a profusion of these within a short radius of the stem the chances of failure are practically nil. A profusion of small roots may be ensured by cutting through at the desired distance from the stem (15 to 24 inches, according to the size of the tree) all roots to a depth of 18 inches. In so doing a trench is made around the tree, and the end of roots carefully pared if the cutting has not been 'clean.'' The trench is then refilled with soil containing a good supply of humus, and in about three months' time the original root ends will have developed a good supply of fibres. At the time of removal these are not interfered with more than can be avoided, the necessary excavation for removing the tree from its original position and severance of any lower roots being made beyond the terminals of the young root growth. The head of a large tree should be materially shortened at the time of removal. The cutting of roots in the first instance should be performed when the tree is in a domant state; in the case of citrus, conditions are generally favourable about March. Tropical varieties handled in this manner can be removed at almost any time after sufficient roots have formed and hardened, and may be first treated at any time of the year at the period known as "between growths."

FLOWER GARDEN.

All the roses should have been pruned some time ago, but do not forget to look over them occasionally, and encourage them in the way they should go by rubbing off any shoots which tend to grow towards the centre. Where there is a fine young shoot growing in the right direction, cut off the old parent branch which it will replace. If this work is done gradually, it will save a great deal of hacking and sawing when next pruning season arrives. Trim and repair the lawns. Plant out antirrhinums (snapdragons), pansies, hollyhocks, verbenas, petunias, &c. Sow zinnias, amaranthus, balsam, chrysanthemum, marigolds, cosmos, coxcombs, phloxes, sweet peas, lupins; and plant gladiolus, tuber-roses, amaryllis, pancratium, ismene, crinums, belladonna, lily, and other bulbs. In the case of dahlias, however, it will be better to place them in some warm, moist spot, where they will start gently and be ready to plant out in a month or two. It must be remembered that this is the driest of our months. During thirty-eight years the average number of rainy days in August was seven, and the mean average rainfall 2.63 in., and for September 2.07, increasing gradually to a rainfall of 7.69 in. in February.

KITCHEN GARDEN.

Nearly all spring and summer crops can now be planted. Here is a list of seeds and roots to be sown which will keep the market gardeners busy for some time: Carrots, parsnips, turnips, beet, lettuce, endive, salsify, radish, rhubarb, asparagus, Jerusalem artichoke, French beans, runner beans of all kinds, peas, parsley, tomato, egg-plant, sea-kale, cucumber, melon, pumpkin, globe artichokes. Set out any cabbage plants and kohl-rabi that are ready. Towards the end of the month plant out tomatoes, melons, cucumbers, &c., which have been raised under cover. Support peas by sticks or wire netting. Pinch off the tops of broad beans as they come into flower to make the beans set. Plough or dig up old cauliflower and cabbage beds, and let them lie in the rough for a month before replanting, so that the soil may get the benefit of the sun and air. Top-dressing, where vegetables have been planted out with fine stable manure, has a most beneficial effect on their growth, as it furnishes a mulch as well as supplies of plant food.

THE CARE OF THE LAWN.

For a lawn to be a success it must be carefully made in the first place. Good drainage is essential, for stagnant water-logged soil encourages weeds and kills the grass. The soil should be rich in plant food. Give the ground a heavy dressing of good manure, and thoroughly dig it over. Enough time should then be allowed for the soil to settle, as it must be firm when the grass is planted or there will be a series of hills and hollows shortly after. In addition to the manure apply the following mixture at the rate of 3 oz. to the square yard, forking or raking it well into the top spit of the soil:—2 lb. superphosphate of lime, 1 lb. bonemeal, and 1 lb. sulphate of ammonia.

Early in the spring, as the grass begins to grow, a heavy roller should be passed several times over the ground.

Lawns showing bare patches will require a dressing during the autumn, and the mixture previously mentioned will be found very suitable, and will keep the grass well nourished. Wood ashes and soot, combined or not, will also be found beneficial. All dressings should be applied during showery weather. If soil poverty is the cause of a patchy lawn, it is best to rake over in the autumn with a sharp-toothed rake, and dress with a good layer of fine soil and wood ashes.

PLATE 73.

Brisbane's Water Supply—High level filter beds, Mount Crosby.

Orchard Notes for August.

THE COASTAL DISTRICTS.

THE bulk of citrus fruits, with the exception of late ripening varieties, will now have been marketed, and cultural operations, pruning, spraying, &c., should be receiving attention. Where trees show indication of impaired vigour, pruning should be heavy, both in respect of thinning and shortening branches. Where trees are vigorous and healthy a light thinning only will be necessary, except in the case of the Glen Retreat Mandarin, which in coastal lands is invariably disposed to produce a profusion of branches, with consequent over-production and weakening of the constitution of the tree in addition to the fruit being small and not of the best quality. Where white louse is present on the main stem (where it almost invariably makes its first appearance) or branches, spraying with lime sulphur solution in the proportion of one part of the concentrate to ten parts of water after the centre of the tree has been opened up by pruning will be found most beneficial.

In dealing with trees which show signs of failing, investigation should be made near the ground level for indications of collar rot, and in the North Coast district particularly, for the presence of the weevil root-borer which may attack the roots in the vicinity of the thin bases or at some feet distant. A very light application of paradichlor, buried a few inches under the soil in circles around the tree and the surface stamped firm, is considered efficacious in destroying the pest. The distance between the circles (shallow openings connected throughout) should not be more than 18 inches. It may be necessary to repeat the application at three to four weeks' intervals.

Spraying with Bordeaux mixture is desirable as it will, if properly applied, destroy the spores of various fungi later attacking both foliage and fruit.

Where for any reason healthy trees of vigorous constitution are unprofitable they should now be headed back—in fact, the whole of the top removed, leaving only a few selected ''arms'' of previous branches, all other branches being cut clean away at their base. Three or four main arms, whose length will vary from 2 to 4 feet according to the size of the tree, will form the future head of the tree, and from these numerous shoots will originate; these shoots in turn are reduced according to circumstances, usually from two to five on each arm, and given fair attention they will be in a fit condition to receive selected buds from a prolific tree by next autumn. It is advisable when the shoots intended for budding have attained a length of about 6 inches to nip off their terminals for the purpose of stiffening their growth, otherwise they are liable to be blown off by winds. All branches or parts removed in pruning should be carefully collected and burned. Applications against pests and disease could hardly be satisfactory if the material for reinfestation is available throughout the orchard.

Working the land is essential, and disc implements give best results. Before ploughing it is advisable to apply the necessary fertilizer, not just around the trees beneath the branches, but over the whole orchard, the feeding roots mainly extending beyond the extremities of the branches. The depth to which ploughing should be effected will depend on the nature of the soil and its original preparation. Where the subsoil is of a permeable nature, or has been broken up in the first instance, ploughing could be much deeper than on land where due consideration had not been given to this practice. It will also be noted that among some of our light loams fertility is confined to a shallow depth, where it would be futile to persist in deep ploughing to force the roots into a subsoil from which they could derive but little sustenance. Following upon ploughing, the soil should be further treated until finely broken; the implement necessary will depend upon the constituency of the soil. Generally a good harrow will meet all requirements. On the completion of ploughing between rows an open furrow should not be left on the border or margin, but two or three furrows should be turned back to fill this and the whole then worked sufficiently to leave an even surface throughout the orchard. Except for the purpose of turning in fertilizer or green manure, a good type of disc cultivator can be substituted for the plough and will give at least an equal result.

The planting of trees may be continued and with the exception of custard apples (which should be left until the end of August) should be expedited. The attention of citrus growers should be confined mainly to good varieties like Joppo, Siletta, and late Valencia. The preserving of orange juice will very materially assist in the absorption of our crop, and the fact that the trees develop much more rapidly in this State

than in Southern producing regions is distinctly in our favour; also our fruit contains a much higher sugar content. This, however, is not to be accepted as an invitation to continue the practice of sending immature fruit to the Southern markets.

Grape vines should be pruned, and where cuttings for planting are required these should be selected, trimmed, and heeled in slightly damp soil. Canes intended for cuttings should not be allowed to lie about and dry out, but treated the day they are severed from the plant. Cuttings are frequently made of excessive length. Ten to twelve inches is a fair length, allowing for insertion in the soil to admit of the top bud with a short section of the internode to protrude. Growth is only desired from the upper or exposed bud.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL pruning other than that applied to peaches and varieties which are late in coming into growth should be completed this month, and the planting of young trees, if not already done, should no longer be delayed. Early planting is preferred, the sooner after the fall of leaves the better. The time is opportune (when there is indication of the buds swelling) to work over (where the stock is reasonably vigorous) unprofitable trees. Strap grafting, as advised by the local field officers, is the most satisfactory method of top-working deciduous trees.

The pruning of vines should be postponed as long as circumstances permit, and these can only be gauged on actual observation as they are subject to much variation.

Late spraying against San José scale where present should be applied with an efficient oil emulsion before any growth appears. Each particular brand has its advocates. Where the scale is persistent a 2 per cent. solution of Volck may be applied subsequent to the appearance of foliage. Both of these sprays are efficacious against peach or other aphis at a much reduced strength. One per cent. has given satisfactory results. The usual winter working of the land is essential for the retention of moisture and aeration of the soil, but in shallow soils in which many orchards are planted deep working is most detrimental. The matter of seedling stocks for apples and the inferior plants frequently received from Southern nurseries prompts a query as to how many seeds have been stratified for spring planting, and if any effort is being made towards raising a local supply of nursery stock.

Farm Notes for August.

THE most important work during August will be the preparation of the land for all spring-sown crops. The better the cultivation the better the results that can be expected. Potato planting will be in full swing this month, and in connection with this crop the prevention of fungoid diseases calls for special attention. Where possible, seed potatoes should be selected from localities which are free from disease; they should be well sprouted, and, if possible, should not exceed 2 oz. in weight. Seed potatoes of this size are more economical to use than those large enough to necessitate cutting. However, if only large-sized seed are procurable, the tubers should be cut so that at least two well-developed eyes are left. The cut surfaces require to be well dusted with slaked lime or wood ashes as soon as possible after cutting. If considered necessary to prevent possible infection by fungoid diseases, potatoes should be dipped in a solution of 1 pint of 40 per cent. formalin to 15 gallons of water, leaving them immersed for one hour. The bags used should also be dipped and thoroughly dried. The potatoes should be spread out and dried before rebagging. Where cut tubers are to be sown, they should be dipped before cutting.

In localities where all danger from frosts is over, sweet potato cuttings may be planted out. This crop deserves more atttention owing to its value for both culinary and stock food purposes.

Arrowroot may also be planted this month in suitable localities.

With the advent of warmer weather weed growth will increase, and cultivators will be kept busy in growing crops, and land being prepared for sorghums, millets, maize, cotton, and summer growing crops generally.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MAY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING MAY, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of Years' Records.	May. 1934.	May. 1933.
North Coast.	In.		In.	In.
Atherton	2·10	33	4·19	2·05
Cairns	4·50	52	4·85	4·59
Cardwell	3 61	62	4·06	5·26
Cooktown	2·83	58	2·85	0·95
Herberton	1·68	48	2·66	3·47
Ingham	3·62	42	4·20	6·32
Innisfail	12 24	53	26·34	8·85
Mossman Mill	3·81	21	2·96	4·17
Townsville	1·30	63	0·24	0·48
Central Coast.				
Ayr	1·13	47	0·80	0·61
Bowen	1·32	63	0·37	1·07
Charters Towers	0·79	52	0·97	0 37
Mackay	3·71	63	3·74	1·32
Proserpine	4·33	31	5·39	4·58
St. Lawrence	1·77	63	1·95	0·64
South Coast.				
Biggenden	1·69	35	1·61	0·64
Bundaberg	2·62	51	1·08	0·98
Brisbane	2·78	83	2·39	0·55
Caboolture	2·81	47	2·89	..
Childers	2·09	39	1·92	0·55
Crohamhurst	4·83	41	5·89	0·40
Esk	1·94	47	2·10	0·21
Gayndah	1·55	63	2·41	0·25
Gympie	2·82	64	2·18	0·69
Kilkivan	1·81	55	1·92	0·62
Maryborough	2·99	63	3·24	0·95
Nambour	4·63	38	7·63	1·03
Nanango	1·50	52	2·93	0·26
Rockhampton	1·64	63	0·82	0·47
Woodford	2·85	47	3·94	0·02

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of Years' Records.	May. 1934.	May. 1933.
Central Highlands.	In.		In.	In.
Clermont	1·27	63	2·12	0·44
Gindie	0·91	35	..	..
Springsure	1·25	65	1·08	0·37
Darling Downs.				
Dalby	1·27	64	3·06	0·23
Emu Vale	1·17	38	0·37	0·39
Hermitage	1·21	28	..	0·34
Jimbour	1·17	46	2·95	0·32
Miles	1·46	49	3·16	0·14
Stanthorpe	1·86	61	0·28	1·17
Toowoomba	2·16	62	2·34	0·71
Warwick	1·54	69	0 15	0·42
Maranoa.				
Roma	1·41	60	0·77	0·20
State Farms, &c.				
Bungeworgorai	0·90	20	0·61	0·10
Gatton College	1·52	35	1·30	0·45
Kairi	2·01	20	..	2·82
Mackay Sugar Experiment Station	3·24	37	3·24	1·72

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MAY, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·93	81	70	84	13, 29	62	10	285	8
Herberton	..	70	57	78	2, 5	43	11	266	14
Rockhampton	30·11	78	60	83	1, 2, 3, 4	54	28	82	6
Brisbane	30·19	72	56	78	1	49	29	239	13
Darling Downs.									
Dalby	30·18	71	46	77	1	35	30	306	8
Stanthorpe	..	65	40	72	13	25	31	28	7
Toowoomba	..	67	47	79	19	35	15	134	7
Mid-Interior.									
Georgetown	29·95	85	62	93	2	48	11	7	2
Longreach	30·10	82	55	89	2	50	9, 31	38	1
Mitchell	30·18	74	44	79	3	35	2, 25, 31	18	3
Western.									
Burketown	29·98	87	66	92	4, 14	55	6	20	2
Boulia	30·08	81	55	88	12	47	9	..	..
Thargomindah	30·18	74	53	80	11	44	31	29	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	July, 1934.		August, 1934.		MOONRISE. July, 1934.	MOONRISE. August, 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·45	5·7	6·35	5·21	9·38	11·32
2	6·45	5·7	6·34	5·22	10·40	a.m.
3	6·45	5·7	6·33	5·23	11·41	12·33
4	6·45	5·8	6·32	5·23	a.m.	1·30
5	6·45	5·8	6·32	5·24	12·40	2·27
6	6·45	5·8	6·31	5·24	1·40	3·20
7	6·45	5·9	6·31	5·25	2·39	4·10
8	6·45	5·9	6·30	5·25	3·36	4·55
9	6·44	5·9	6·29	5·26	4·31	5·37
10	6·44	5·10	6·29	5·26	5·24	6·10
11	6·44	5·10	6·28	5·27	6·12	6·42
12	6·44	5·10	6·27	5·27	6·57	7·14
13	6·44	5·11	6·26	5·28	7 35	7·39
14	6·44	5·11	6·25	5·28	8·9	8·9
15	6·44	5·12	6·24	5·29	8·39	8·38
16	6·43	5·12	6·23	5·30	9·10	9·9
17	6·43	5·13	6·22	5·30	9·35	9·47
18	6·43	5·13	6·21	5·31	10·5	10 29
19	6·42	5·14	6·20	5·31	10·36	11·18
						p.m.
20	6·42	5·14	6·19	5·32	11·8	12·17
21	6·41	5·15	6·18	5·32	11·47	1·22
					p.m.	
22	6·41	5·15	6·18	5·32	12·34	2·31
23	6·40	5·16	6·17	5·33	1·30	3·43
24	6·40	5·16	6·16	5·33	2·35	4·54
25	6·39	5·17	6·15	5·34	3·44	6·4
26	6·39	5·17	6·14	5·34	4·55	7·9
27	6·38	5·18	6·13	5·35	6·9	8·14
28	6·38	5·18	6·12	5·35	7·18	9·17
29	6·37	5·19	6.11	5.36	8·24	10·20
30	6·37	5 19	6·10	5·36	9·27	11·22
31	6·36	5·20	6·9	5·37	10·29	..

Phases of the Moon, Occultations, &c.

4 July. ☽ Last Quarter 6 28 a.m.
12 ,, ● New Moon 3 6 a.m.
20 ,, ☾ First Quarter 4 53 a.m.
26 ,, ○ Full Moon 10 9 p.m.

Apogee, 13th July at 4.12 a.m.
Perigee, 26th July at 8.18 p.m.

On the 5th the Earth will be in that part of its orbit most distant from the Sun, at a distance of over 94 million miles. At 11 o'clock at night the Moon will be passing Uranus, which requires binoculars or telescope to be seen. Two days later the Moon will be passing from west to east of Venus which will then be more than 100 million miles from the Earth.

At 5 o'clock in the morning on the 10th the Moon will be passing Mars, 3 degrees northward of it, shortly before they both rise over the eastern horizon. A glimpse of this nearness may be obtained before daylight supervenes.

Mercury will be in inferior conjunction with the Sun on the 11th. As Mercury will be nearly 7 degrees further north than the Sun the planet will not actually pass exactly between the Earth and it.

The interesting spectacle of a partial eclipse of the Moon will be afforded on 26th July. The Moon will begin to dip into the shadow of the Earth at 7.50 p.m., but the eclipse will not become generally noticeable until 8.54 p.m., when a dark notch will begin to grow low down on its north-eastern edge. The Moon, having risen about 5 p.m., will be four hours high and be about 20½ degrees south, 7 degrees N.N.E. (nearly) of the zenith of Brisbane. The dark notch on the Moon will increase till 10.15 p.m., when the Moon will be rather more than half immersed. After this it will gradually decrease until 11.36 p.m., when the Moon will emerge from the darker shadow, but still be in the almost unnoticeable penumbra for an hour and ten minutes longer.

Mercury on the 31st will reach its greatest elongation, 19 degrees west of the Sun, and will rise one hour 12 minutes before it.

Mercury sets at 6.17 p.m., one hour 10 minutes after the Sun on the 1st; on the 15th it rises 34 minutes before the Sun.

Venus rises at 4.4 a.m. on the 1st and at 4.25 a.m. on the 15th.

Mars rises at 5.24 a.m. on the 1st and at 5.11 a.m. on the 15th.

Jupiter rises at 12 noon on the 1st and sets at 12.24 a.m. on the 15th.

Saturn rises at 8.47 p.m. on the 1st and at 7.50 p.m. on the 15th.

2 Aug. ☽ Last Quarter 4 27 p.m.
10 ,, ● New Moon 6 46 p.m.
18 ,, ☾ First Quarter 2 33 p.m.
25 ,, ○ Full Moon 5 37 a.m.

Apogee, 9th August, at 7·12 a.m.
Perigee, 24th August, at 5·48 a.m.

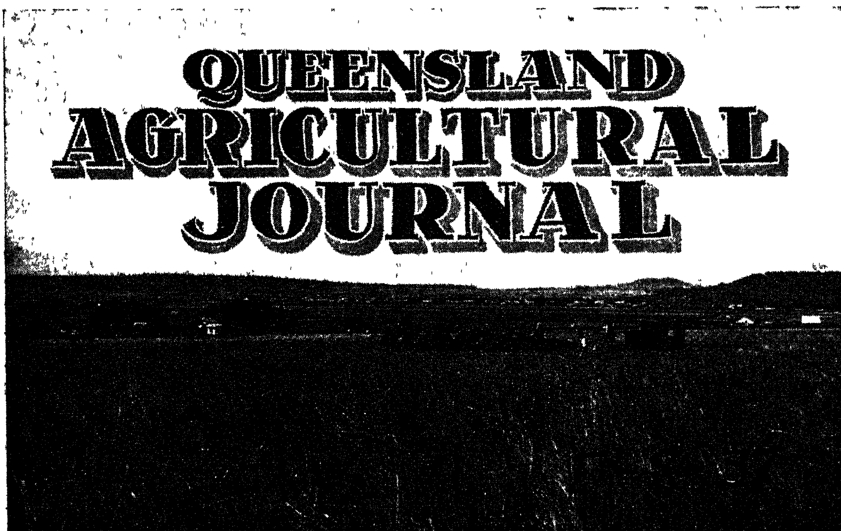
For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes, at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.



VOL. XLII. 1 AUGUST, 1934. PART 2.

Event and Comment.

Progress of the North.

ON his return from Cairns and Townsville, His Excellency the Governor, Sir Leslie Orme Wilson, said that he was impressed more than ever by the progress of the North. On every side there were indications of new development, and the people were looking forward with eager optimism.

At Townsville, he said, he was particularly pleased to have the opportunity of travelling along the Mount Spec road as far as it had been completed. He was taken by rail motor to Mongobulla and thence drove by car 9 miles up the mountain road. The road passed through glorious forest scenery, with wonderful distant views and some delightful wayside beauty spots, such as Saltwater Creek. When completed to the 3,000-feet summit of Mount Spec, the road would give a delightful summer resort to the people of Townsville. To him, however, its great importance lay in the fact that it was proposed to continue the road from the top of Mount Spec into the country beyond, and eventually to link up with Georgetown. When this was done the Gulf people would have another and nearer outlet to the coast. The road would open up valuable mineral country to the west of Townsville.

After opening a fine show at Townsville, the Governor went to Cairns and spent two days touring the Tableland district, which he first visited fourteen months ago. He was glad to have another chance of seeing this great country. He motored up the range road to Yungaburra, and thence to Herberton, Atherton, and Ravenshoe. Unfortunately, rain fell most of the time. The warm welcome he received, however, atoned for the weather's unkindness. On this visit he found that the season had not been very good, because of excessive rain, but, as always, there was a great feeling of optimism among the people.

From Cairns he travelled along the new Cook Highway to Mossman, where he spent a day. This road, like the Mount Spec road, is a fine piece of engineering, and he hoped that it would soon be extended to Cooktown. The scenery is magnificent, and without doubt will attract many tourists, but even without that the road is of the utmost value to the district, as it gives Mossman and Port Douglas direct road communication with Cairns. Mossman, which is as fertile as it is beautiful, is progressing remarkably, said His Excellency, in concluding an interesting comment on his visit to the North.

Britain and Dominion Trade.

SPEAKING at a function arranged in his honour by the Glasgow Chamber of Commerce, at Glasgow, on 18th June, the Premier of Queensland, Hon. W. Forgan Smith, said he felt positive that there was a definite public opinion among all people in Great Britain in favour of very close relations within the British Commonwealth of Nations. That was a very good thing, and spoke well for the future.

"It is important" he added, "that this unity within the Commonwealth should be made stronger and stronger as the years go on, because I believe that we have a mission to perform, that the world requires a lead in the interests of civilisation itself, and there is no organisation in the world to-day which could more effectively give that lead than the British Commonwealth of Nations."

On the question of trade, Mr. Smith said it had been suggested to them that their competition with the British farmer was reacting detrimentally to British interests. It had been suggested that Australian produce should be limited, and that they should be subject to quotas.

They in Australia were perturbed about such proposals, because they were contrary to the aim and purpose of the Australian people. First of all, they regarded them as bad economics.

He pointed out that in Australia there were hundreds of thousands of acres that were yet awaiting development. "In these circumstances," he added, "for us to agree to any policy of restriction would mean that we agreed to arrested development, that the unemployed should have no opportunity of getting work, and, more tragic than anything, that boys leaving school would not be absorbed into useful industry.

"We cannot agree to these things. We desire increased production, increased settlement, and increased developmnt of our own country. Furthermore, it must be realised that Australia is a debtor country. We must, therefore, meet our obligations in the form of export produce."

They were very proud of the fact, he observed, that Australia had met all its obligations on the due date. They were determined to continue to do so, but they must have the capacity to produce and the right to sell.

Dealing with the export of meat from Australia, Mr. Smith said it had been stated that such competition was detrimental to the growers of beef and mutton in Great Britain. Such was not the case. Australia competed not with the British farmer but with foreign countries. Britain definitely imported more from foreign countries than from the Dominions and Crown colonies, so that their competition in British markets was not with the British farmer but with the producers in foreign countries.

When they talked of trade within the Empire they in Australia were not asking for anything they were not prepared themselves to give. Their imports from Britain were increasing rapidly as the result of the Ottawa Conference.

Restriction of Exports.

ADDRESSING a large gathering of producers at Nambour last month, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said that the question of the limitation of production about which they had heard so much recently, transcended party politics, and it was a matter associated intimately with the well-being of the nation. In recent conferences with which he had been associated he had not heard the term, restriction of production used. The term restriction of exports had been used, and it implied a relation to practically every commodity upon which the country had built up its national solvency. It had been said that if they restricted they would get higher prices for the commodity which they exported. But experience did not indicate that such was a fact. Last year butter exports were restricted for a certain period, and it was held that the price would be enhanced on the London market. In consequence of withholding certain supplies Queensland was harder hit than any of the other States of the Commonwealth at that time, because substantial charges in commission and storage had to be met. At that very time there was a fall on the London market, therefore there was little encouragement to believe that by holding back supplies they would obtain enhanced prices.

The time had gone when Australia could regard itself as an entity sufficient unto herself. Queensland was but one part of an economic whole, and the whole basis of the question was what was termed economic nationalism. That policy, however, could not, in his opinion, be sustained in the final analysis. Some countries were already feeling the burden of that policy and were preferring to go back to the old system of producing what they could economically and purchasing abroad what they could afford and what could not be produced economically at home. Theories of economics which were acceptable to one generation were not acceptable in another. If any truth had been brought home poignantly it was the interdependence of one nation upon another.

Queensland Citrus Scale Insects and their Control.

By W. A. T. SUMMERVILLE, M.Sc., Assistant Entomologist.

(Continued from page 33.)

CONTROL OF INDIVIDUAL SPECIES OF SCALE INSECTS.

ALTHOUGH, as has been pointed out, scale insects, as a rule, occur in mixed populations, at times the control work can be confined to one species. Further, in order to understand fully the recommendations for combating complexities, it is necessary for growers to know how to control each species separately. For these reasons growers should study the following paragraphs dealing with each species.

Red Scale.

In so far as the coastal districts of the State are concerned, except in isolated places where the topography of the country exerts sufficient influence to cause materially higher temperature and perhaps lower rainfall than normally exists in coastal areas, red scale should occur as a serious pest only in abnormally dry times on trees other than lemons. If, therefore, in these districts a tree of any variety other than lemon be persistently heavily attacked by that scale, the true cause of the trouble is to be sought in some other factor affecting the health of the tree. Under some circumstances it is useless endeavouring to control the red scale satisfactorily until the health of the tree is improved. In most coastal areas, therefore, the first step in combating this scale is to examine the tree thoroughly for other trouble. Probably the two commonest injurious agents in this connection are the root bark channeller, *Pseudomydaus citriperda* Tryon and melanose, *Phomopsis citri*, and more often than anything else poor cultural conditions. In many cases all that is required to reduce the red scale infestation to insignificance is the use of fertilizer coupled with improved methods of cultivation. Active control measures, as described below, will, of course, accompany such operations to a certain extent, at least in the first instance.

In districts where the insect is a pest of otherwise healthy trees, fumigation should be practised where possible. Both the resin-soda-fish oil mixture and the oil sprays are also effective, and though not so efficient may be substituted for fumigation.

Seasonal life history studies show that there is no period of the year, except, perhaps, in winter, when reproduction is not in progress. Unfortunately, the winter is not a very good time to combat the pest. Red scale, though dead, may remain on the fruit for a considerable time unless appreciable expansion of the rind takes place, and thus, if the control be established too late, brushing of the fruit may still be necessary. Naturally, the dead scales are more easily removed than the living, but brushing is undesirable for other reasons. Further, early fruit, particularly mandarins and navels, are harvested very early in

the winter or even before the really cold weather begins, and thus the fruit on such trees would often be removed before control operations began. To the small grower with trees of early, mid-season, and late fruit, winter fumigation would cause much inconvenience, owing to its coinciding with harvesting and other operations, and would necessitate additional labour costs. Thus, though winter fumigation is effective and safe, it cannot be recommended for general use. The resin-soda-fish oil spray may be used in winter control work, but oil sprays should not be employed then.

By far the best period to establish control of red scale is between early March and the middle of April. If a good kill be obtained at this time the trees under normal circumstances will remain commercially free of the scale until January of the following year. During January the populations will perhaps be again built up considerably, and this sometimes leads orchardists into endeavouring to control the scale in that month. However, it is during the driest times that the red scale becomes most troublesome, and usually spraying cannot be carried out in January owing to the weather conditions. Fumigation may often be carried out at such times, but it must be remembered that the pest has still to pass through a period of prolific reproduction and therefore the establishment of a lasting control is not assured no matter how good the kill obtained. February is similar to January until the monsoonal rains commence, and from then until the rains cease pest control work cannot be undertaken. After the rains have finished a little time must be allowed to elapse to enable the recent growth to harden, otherwise this may be checked by the scalicide. As soon as conditions permit of the control work the colonies should be examined for parasites and the likelihood of any large hatch. Then, provided parasitation does not render artificial control unnecessary, the application should be timed to operate against the scales when there is a predominance of young, should such occur. The work should be allowed to wait as long as possible as the nearer it is done to the winter the more lasting the control will be. It must be remembered that six weeks will probably elapse between the time the scale is killed and when it will fall from the fruit, and also that if oil be used late this will interfere with the artificial colouring of early fruit.

This recommendation is based on the assumption that monsoonal rain will fall during February and March. If the dry season be protracted abnormally it may be that the scale position will become acute before the best period for control as outlined above arrives. Such a situation however is likely to occur only in the more inland parts. In many such districts irrigation is carried out, and a good deal can be done towards relieving the position by using plenty of water. It has been shown experimentally at Gayndah that by the use of water heavily-infested trees can be kept in fair condition for a considerable time longer than would otherwise be possible. If, therefore, orchardists find that the red scale is becoming a menace very much earlier than it is desirable to carry out control, steps must be taken to ensure the trees as good conditions as possible. It must be remembered that it is in these particularly dry seasons that red scale is most prolific, and therefore the

establishment of lasting control at such times by early work is considerably more unlikely. It is in such seasons as this that the larger horned citrus bug, *Biprorulus bibax* Breddin will most likely be in evidence, and in such circumstances reference should be made to the recommendations for the control of this complex of pests as given in connection with notes on the Rockhampton district.

In far-western areas it may at times be inadvisable to allow red scale to breed uninterruptedly for twelve months. This will be the case particularly when the winter is very mild or of but short duration. In such cases observation should be made on the trees during November, as otherwise the position may not be apparent until well into December, and control at such a time in these parts is only accomplished with great risk to the trees. If early summer control be established, it may happen that the trees remain fairly clean for several months with the result that the late summer-autumn period control is allowed to pass. This will mean that control will probably be again necessary in the early summer. In this way the main control period may become fixed for early summer. Control at this season is definitely less satisfactory than at the time recommended for general use, and, therefore, care should be taken to guard against this happening. It is necessary in such cases to examine the twigs and small branches and not be guided solely by the fruit infestation.

When two treatments in one year are necessary, only one should be an oil spray. Any other combination of scalicides will be more satisfactory than two oil sprayings. If oil and hydrocyanic acid are to be used it is generally found more satisfactory to use the fumigant for the first treatment.

The foregoing remarks apply essentially to older trees. Young trees may be attacked in any district. Trees purchased from a nursery and found to be heavily infested with red scale should not be accepted, as control of the scale is frequently obtained only at too great expense to the health of young trees. Any young tree, however, may carry a few red scale individuals, and these do not matter greatly and with most varieties other than lemons, and perhaps grapefruit, it will be found that these light infestations are thrown off naturally soon after the trees become established. Light oil sprayings may be used on young trees once these have become established, but even with these fumigation is preferable to all other treatments.

In general, red scale control operations in this State have previously been carried out mainly in November or thereabout. The recent investigations however have demonstrated that much better results are to be obtained by working during the late summer and autumn and that at such times the risk of injury to the trees is greatly lessened.

Circular Black Scale.

It will be seen from what has been recorded of the seasonal life history that young of circular black scale will ordinarily predominate in September, November, January, and March. Fumigation or spraying in September cannot be recommended owing to the possibility of injury to the tree, and January is normally too hot and too dry to permit of

control work being recommended for the districts in which this species is a pest. November and March, then, become the only periods in which control operations can be advised. Of the two March, or perhaps April, according to weather conditions, is preferred for the following reasons:—(1) In November the risk of injuring the tree, though not great, is still greater than in the late summer or autumn. (2) As has been mentioned in connection with the habits of the pest, the greatest objection to the scale is that it disfigures the fruit. The individuals do not migrate to the fruit to any extent until the late summer, and at this time a big proportion of the emerging young settle down on the fruit. Thus even if a good kill be obtained in November a period of great reproductivity has still to be passed through, and it is possible that before the fruit is harvested the fruit may carry an infestation. It is even possible that the whole tree may be again infested before the winter. It must be remembered that circular black is not a particularly injurious scale on the tree, so that the extra damage done by leaving the trees infested for somewhat longer than may be absolutely necessary will not matter greatly. (3) Breeding in the winter is at a standstill for all practical purposes and thus good control established in March or April ensures a low scale population for a longer period than at any other time of the year. (4) Circular black is commonly associated with red scale, and as the same scalicides are effective against both species it is advantageous to make one application suffice for both pests if possible. (5) A most important natural enemy of this scale commonly builds up a population during the summer months, and early in March it is commonly possible to assess the amount of scale which can be anticipated at harvesting time. This in itself if often of importance, for this enemy, *Catoblemna dubia* Butl., quite frequently removes heavy infestations of the pest and thus eliminates the necessity for artificial control.

It is recommended therefore that, though the late summer brood is rather more uneven than any other, control measures against circular black scale should be applied in March or thereabouts according to the time of emergence of the late summer brood. On the leaves circular black scale is not particularly difficult to kill, but the adult females on the fruit at the time of reproduction adhere very tightly to the rind and are thus more difficult to reach with sprays. It is therefore advisable to apply sprays at a time when the minimum possible number of females are reproducing. This means waiting until the fourth hatch is completed or as near that time as possible. If, as commonly happens, the red scale and circular black are associated, the time of application will usually be decided by the requirements for the dominant species but reproducing circular black on the fruit is less susceptible to sprays than is the red, and this point must be borne in mind.

As has been indicated fumigation, or spraying with oil or the resin-soda-fish oil mixture, may be employed against this species.

Mussel Scale.

Mussel scale is one of the most difficult citrus scale insects to control satisfactorily and orchardists should not neglect any appreciable infestations. It has been pointed out that lack of vigour is an important

factor predisposing the tree to heavy infestation, and the first recommendation therefore is to attend to the health of the plant. In this connection reference should be made to the remarks made in the discussion on the control of red scale. In the case of mussel scale, the bronze orange bug, *Rhœcocoris sulciventris* Stol., is a further important accessory to infestation and of most importance is the succession of mussel scale following injury by pink wax.

When good, vigorous trees are attacked the infestation is usually wholly confined to the fruit, and care must be taken to examine these in the early months of the year paying particular attention to the points of contact and the stem ends.

On account of the continuity of breeding no specific time can be given when young will probably predominate. At the same time, in the majority of orchards control operations can be timed to coincide with a large hatch of young and observations should always be made to ensure this if at all possible. As has been mentioned in connection with the life history, there is sometimes an approach to a pure brood during the latter part of February and, provided control operations are not delayed too long by rain, use may be made of such an occurrence. As the scales usually infest the fruit only after the middle of summer, it is towards the end of that season or in autumn that control generally is most desirable and in so far as healthy trees are concerned this is invariably the best time to combat the pest. On other trees any opportunity offered by suitable conditions of breeding and the state of the trees should be taken. In general, however, it will be found that late summer or autumn work will be attended by the best results in all cases.

Fumigation is most effective and should be employed where practicable. Spraying with straight oil cannot be recommended as certain to give commercial control against the heaviest infestations unless young predominate to the practical exclusion of other stages. Excellent results in all experimental work were obtained with the resin-soda-fish oil spray and this mixture can be recommended against even the heaviest infestations. Against light infestations, particularly when pink wax must be combated at the same time, the combination of soap and washing soda with oil may be used with success. This combination, though not so effective as the resin-soda-fish oil mixture, is considerably superior to straight oil.

White Louse.

This scale is very susceptible to hydrocyanic acid gas and control of the pest can be established at any time when fumigation is practicable. The white louse is also effectively combated with lime sulphur, and for reasons arising out of the use of these two scalicides at various times the control of the pest is generally best accomplished by the use of the spray. The best practice is to use lime sulphur in the late winter just before blossoming time at a strength of 1 to 12. By using the spray at this time a single application rids the tree of white louse before the new season growth appears and at the same time many other bark troubles are brought under control.

Whilst both lime sulphur and hydrocyanic acid gas are effective at almost any time against this scale insect the careful orchardist will always examine the colony to make sure that he is not operating just prior to an extensive egg hatch or that natural enemies, particularly the predatory moth *C. dubia,* are not present in large numbers—the latter a by no means rare occurrence late in the summer.

The resin-soda-fish oil mixture is also very effective against this pest.

Hemispherical Scale.

Due to a great extent to the activity of natural enemies it is seldom necessary to apply artificial control measures against the hemispherical scale. Before applying such measures it is always advisable to examine the colonies and learn to what extent parasites are present. It will generally be found that by the time the population of this scale is so large that the necessity for control measures is suggested, parasitism is so high that the infestation will soon be reduced to insignificance.

When exceptionally heavy infestations do occur these are never in evidence before January, and though November spraying may be carried out this is not likely to be of any practical value. January work cannot be recommended owing to the probability of adverse weather conditions. In general then the opportunities offered by the occurrence of young in March and April should be taken when artificial control is necessary. If spraying be delayed until the dormant season is very close, the resin-soda-fish oil mixture should be used, but if March work be possible either this mixture or oil may be used. The oil-lime sulphur combination should generally be more useful than straight oil, owing to the possible need for control of red spider or Maori at this time. Fumigation is effective, but hemispherical scale reaches its maximum and indeed only economic importance in those districts where fumigation cannot be satisfactorily used.

Olive Scale.

In no case has this insect been found in sufficient numbers in Queensland to cause the slightest concern, and it is most unlikely that artificial control of the species will be required. No experimental control work has been possible, and, in the circumstances, no definite recommendations can be made. It is probable that the recommendations made for hemispherical scale as above would give satisfactory results against olive scale.

Soft Brown Scale.

In no instance has this scale been seen on citrus in this State in appreciable numbers, and the small colonies which do occur are always confined to at most a few twigs on one or two trees in the orchard. Even in these the percentage parasitised is almost always very high and control by artificial means is thus not called for in any case. All that need be done in any case is to remove those twigs which carry colonies as soon as they are noticed. Fumigation and oil sprays have been found effective against this species in other countries.

Long Soft Scale.

When artificial control of this species is desired, either fumigation or oil spraying may be employed. Though the adults are rather soft bodied they appear to be rather more resistant to oil than might be expected and therefore control operations should be directed against the youngest stage possible. As the seasonal life history is not definitely known, the best time for applying control measures cannot be stated; but from experimental work it appears that late summer-autumn applications will give quite satisfactory results. As the scale is commonly accompanied by a growth of sooty mould control at this time is usually more desirable than at any other season.

Flat Scale.

With this species also artificial control measures have not so far been required and no experimental work has been done on this point. It is probable, however, that fumigation or oil spraying when the young are dominant would effectively control the insect.

Pulvinaria Scale.

Pulvinaria is not a difficult pest to control. Fumigation cannot be recommended in those districts in which the pest is of importance, but both oil and the resin-soda-fish oil mixture are effective. Of the two sprays the latter is to be preferred in general, on account of the fact that the control of the scale insect and the bronze orange bug can be effected concurrently by the use of this material and the two pests are commonly associated. The spray is effective against the scales many weeks old and generally the application can be made at the time most opportune for the control of the bug. Apart from this the mixture is more efficient against the scale insect than is the straight oil.

It is very fortunate that the females of Pulvinaria scale move from the twigs to the leaves to produce the large white ovisacs and thus become very conspicuous at this time. The most important point to be observed is that spraying must not be done too early. It is essential that the hatchings be complete and it will be noted that young do not emerge for upwards of a fortnight after the ovisac formation. It is the defunct ovisacs or their remains which must be looked for and not those full of eggs.

Where no other pest is to be considered control operations will be commenced as early as possible and in such cases, as the scale is often confined to but a portion of the tree and sometimes to only a limited number of trees, spot spraying may be profitably employed.

Pink Wax.

There is no other citrus scale insect in the State against which so much unsatisfactory work is done as pink wax. Failures are generally due to neglecting to give full consideration to the seasonal life history and habits of the pest.

From what has been recorded in earlier paragraphs it will be seen that there are two periods each year when young may be expected to occur either as the progeny of individuals already in the orchard or as

migrants from outside sources. As the outside sources are very extensive, control operations must be delayed until all the young which are going to arrive in the orchard have done so. The time of reproductivity in both orchards and natural forest will generally be found to practically coincide except where some factor such as irrigation enters. In most cases then the emergence need only be observed on orchard trees. However, as the outside breeding grounds are usually easily and quickly accessible it might always be advisable to carry out inspections of these sources. As has been recorded egg hatching is normally spread over a period of about one month. During this time the young grow to about the size of the head of an ordinary pin or a little larger. Thus by spraying when the typical young are about that size further infestation is unlikely to occur. The soap and washing soda spray is effective against young up to that size, but the efficiency quickly drops from that time onwards and therefore the application must not be too long delayed if good results are to be obtained. At times, owing probably to unusual weather conditions, the breeding is rather protracted, with the result that a big proportion of the first hatched young reach the size given above before reproduction is nearly finished. In such times as these the procedure will be dictated by the degree of infestation. If the number of females left to reproduce is rather small when the ordinary correct time of application is at hand, these may be ignored though, of course, this lowers the standard of control. If on the other hand the numbers are about equally divided it may be necessary to substitute the resin-soda-fish oil spray for the soap and washing soda and spray as late as possible without allowing too big a proportion of the young to grow to twice the size indicated above. The first-mentioned mixture is effective up to that time, but neither washing soda wash nor the soap and washing soda spray can be recommended against individuals appreciably larger than the head of a pin. The essential observations then are the size of the young together with the proportion of adult females which are reproducing. Each of these must be observed, otherwise confusing data will be obtained.

The times of appearance of the young vary considerably and the time of application of the scalicide may be in November or early December for the early summer generation and from late February to late April for the late summer brood.

In addition to the sprays given above hydrocyanic acid gas may be employed for the control of pink wax. When generated by the pot method the results are quite satisfactory and fumigation by this method can be recommended against the heaviest infestations of this pest. When calcium cyanide is employed the results are not so satisfactory and against very heavy infestations the sprays are superior. However, against ordinary or light colonies calcium cyanide fumigation is quite efficient.

White Wax.

It is very seldom necessary to apply artificial means of control against white wax in Queensland. The scale is usually confined to but a few branches on a few trees, and generally the entire colony can be removed and burned with the infested branch. With more general infestations however, spraying must be resorted to and when this is the case it is necessary to operate against the young as far as possible.

From the work done on the life history it appears that the period of control may occur any time between late January and the end of March, or perhaps even later. As with pink wax it is essential that the hatching be completed before the control measure be applied.

Soap and washing soda spray is effective only against the very young individuals and cannot be recommended against those which are at all well grown. The washing soda wash and the resin-soda-fish oil spray were both found satisfactory, and of the two the latter gave the best results in experimental work.

Cottony Cushion Scale and Mealy Bug.

Artificial control of either cottony cushion scale or the mealy bug is rarely called for in this State. Where large colonies of either occur it is generally due to the temporary absence of important natural enemies, particularly the ladybird *Cryptolæmus montrouzieri*. When the population of either species of coccid is observed to be increasing unduly a colony of the useful insect should be obtained. Generally in western areas the ladybird is common on prickly-pear where it finds another mealy bug to prey upon, whilst in coastal districts it is frequently to be found in large numbers on the bunya pine, *Auracaria bidwillii,* on which tree it is feeding on another species of coccid. Often, too, it may be absent from one orchard and be present in large numbers on a second only a few miles away. Growers then can most frequently supply the deficiency for themselves. The ladybirds should be given careful treatment, and if being transported in the larval or adult stage should be provided with a supply of mealy bugs or scale insects to avoid starvation. Fumigation or the resin-soda-fish oil may be employed if artificial control be desired.

SCALE INSECT CONTROL IN VARIOUS DISTRICTS WITH PARTICULAR REFERENCE TO COMPLEXES WITH OTHER PESTS AND DISEASES.

It is comparatively seldom that the problem of scale control is a matter concerning one species of scale only. In by far the greatest number of cases the grower requires to combat mixed populations of these parts. Furthermore, the occurrence of another pest or a disease may mean that it is either necessary or at least economical to vary the scale treatment from the one which would be used to combat the scale alone. Thus the value of simple recommendations for the control of individual species is rather limited. Table VI. shows, for the various districts, the complexes, which include scale insects. The manner in which the situations arising out of these mixed populations of pests can be best dealt with is outlined in later paragraphs. Variations from what has been given as the normal for each district may be found, and it is possible that the position on any one orchard will be more closely allied to what has been described for trees in other localities. It may therefore be advisable to peruse the notes on districts other than the one in which the orchard is situated. Apart from the more typical complications many others are to be found which cannot be included, but growers should be able to solve many of the problems for themselves after studying the manner in which parallel ones are attacked.

TABLE VI.

District.	Dominant Scale.	Pest or Disease likely to cause Modification of Treatment.		Other Scales of Importance.
		Pest.	Disease.	
Tamborine Mt. ..	Mussel	Red Scale Bronze Orange Bug	Melanose	
Redland Bay-Cleveland	Pink Wax	Mussel Scale Bronze Orange Bug Maori	Melanose	White Louse
	Red	Maori		
Brisbane to Landsborough	Pink Wax	Bronze Orange Bug Mussel Scale	Scab Melanose	White Louse
	Red	Larger Horned Citrus Bug	Scab Melanose	
Palmwoods, Woombye, Nambour	Pink Wax	Mussel Scale Pulvinaria Scale Bronze Orange Bug	Melanose Black Spot Scab Fly Speck	White Louse
	Red	Larger Horned Citrus Bug Pink Wax	Black Spot Scab Melanose	
Buderim Mt.	Pink Wax	Mussel Scale Bronze Orange Bug Red Scale	Melanose Black Spot	
Blackall Range ..	Mussel Pulvinaria	Bronze Orange Bug	Melanose Black Spot Fly Speck Scab	Pink Wax
Yandina to Gympie ..	Pink Wax	Mussel Scale Bronze Orange Bug	Melanose Scab	White Louse
	Red		Scab	
Burrum	Pink Wax	Mussel Scale Red Scale	Black Spot Emperor Brown Spot	White Louse
Rockhampton ..	Red	Circular Black Scale Mussel Scale Larger Horned Citrus Bug	Black Spot Scab	White Louse Long Soft Scale
	Pink Wax	Mussel Scale	Black Spot	
Yeppoon	Pink Wax	Mussel Scale Red Scale	Melanose	Long Soft Scale
Byfield..	Pink Wax	Mussel Scale	Melanose Fly Speck	
Gayndah	Red	Circular Black Scale Larger Horned Citrus Bug Pink Wax	Black Spot Scab	White Louse
Lockyer	Pink Wax	Mussel Scale	Melanose	White Louse
	Red	Circular Black Scale	Melanose	
Esk	Pink Wax	Circular Black Scale Red Scale	Melanose	White Louse
Roma and Far West..	Red	Larger Horned Citrus Bug Circular Black Scale		White Louse

Tamborine Mountain.

Mussel scale is the most commonly found species in the Tamborine district, whilst red scale and pink wax are also fairly abundant. A little hemispherical scale is also to be found at times. That mussel and red scales are of such importance in this district is due in part to the lack of vigour of many trees. As has been pointed out lack of vigour is an

important predisposing factor with each of these species. The reasons for the condition of the trees are purely cultural for the most part and cannot be discussed here. It must be pointed out, however, that very few growers appear to realise fully the ill-effects of constant winds on citrus trees. In so far as the scale position is concerned, there are two main effects of these winds. In the first place, natural enemies, particularly entomogenous fungi such as *Spaerostilbe coccophila,* are much more active in protected places than where the trees are exposed to constant dessicating winds and this is undoubtedly a contributing factor in many instances. However, the greatest cause of heavy scale population in this district is to be looked for mainly in the action of the winds on the trees themselves, and the provision of windbreaks will certainly improve the position with respect to the dominant scale species quite apart from the consequent increase in natural control. Consideration should be given to the provision of windbreaks, and, above all, it is essential that existing natural windbreaks should be preserved as far as possible. Melanose and pests which impair the vigour of the trees also contribute in some orchards to the unsatisfactory scale position. If the health of the trees be given proper attention it will be found that the only artificial control measure which need be applied against the scale insects at Tamborine Mountain is the use of the resin-soda-fish oil spray as recommended for combating the bronze orange bug.

Redland Bay-Cleveland District.

In the Redland Bay-Cleveland district there are two distinct types of scale infestation to be found. For the most part only one type is present on each orchard, but in some cases both types may be present on different trees in the one orchard and on occasions the types are merged. The first type, which is generally the most severe but which is the less common, has red scale as the dominant species. Mussel scale may be present and the trees commonly carry a good deal of white louse. This association is brought about to a large degree by the subnormal vigour of the trees and is consequently mostly in evidence on orchards on weaker soils or in exposed positions. Exposure to strong winds is a definite factor in the health of many of the trees in this district, and for the most part elimination or considerable reduction in the influence of these by the provision of windbreaks will accomplish much towards the control of these scale pests. In other parts cultural conditions need attention, and for the most part in these cases it appears that nitrogen deficiency of the soils should be made good as a first step towards the commercial control of this type of scale insect association. Owing to the breeding grounds provided by trees such as those mentioned above, these scale insects may spread to nearby healthy trees to a small extent, and it is on such trees that the two types of infestation may merge as mentioned above. Where possible it is obviously of first importance to reduce the breeding grounds and to correct predisposing factors, and artificial control must be considered of secondary importance for the most part where this type of scale population predominates. Where conditions are such that commercial control is possible by purely artificial methods, oil or the oil-soap-washing soda combination will give beneficial results if applied in accordance with the requirements of the dominant species. If Maori be abundant during the control period the oil-lime sulphur combination may be used if the temperatures are not excessive. The resin-soda-fish oil mixture will very often give the most lasting beneficial results, particularly where the mussel scale is heavy.

The second type of infestation is one in which pink wax is predominant, at least in the first place, and in which mussel scale is an important factor. White louse may also occur on these trees but is generally less evident than with trees affected by the first-mentioned scale complex. Pulvinaria scale is commonly found but usually in small infestations on any one tree. The trees carrying this pink wax mussel scale complex are, for the most part, the more vigorous ones and consequently the bronze orange bug may also be present. Melanose may be found on these trees, but usually it gives concern only in so far as it causes blemishes on the fruit. With this type of association the mussel scale is generally of importance only as a pest of the fruit, but if the trees be neglected for any length of time this scale may become more and more important until finally pink wax becomes of little moment and the twig and branch infestation by the mussel scale assumes major significance.

In so far as this type of association is concerned the use of soap and washing soda in the early summer as required for the control of pink wax, followed in the late summer or autumn by a thorough spraying with the resin-soda-fish oil mixture is to be recommended. If the pink wax be very prevalent the second application should be timed as required for the control of that pest, but if the bronze orange bug be of more importance the resin-soda-fish oil spraying should be applied as recommended for the control of that species, and this in general will suffice for the control of both scales and bug. In abnormal cases it may be necessary to establish special control of the pink wax earlier and then the soap and washing soda spray should be applied. This, however, will rarely be required. If the melanose is to be combated it may be necessary to use the combination of Burgundy-soap and washing soda in place of straight soap and washing soda in the early summer. If the bronze orange bug is not to be considered at all oil-soap-washing soda may be substituted for the resin-soda-fish oil spray, but this is not to be generally advised.

Brisbane to Landsborough.

From Brisbane to Landsborough orchards are for the most part small isolated areas, and consequently conditions change greatly from orchard to orchard. Much of what has been written concerning the Redland Bay-Cleveland district applies to this area also. There are, however, a few places in which, owing to purely local conditions, red scale becomes a pest of fairly vigorous trees. A proportion of the orchards in this district are situated on unsuitable soil, however, and this is more often a factor in red scale incidence than is climate. Bronze orange bug occurs throughout the area, but as handpicking suffices for the control of this pest in most cases in the area under consideration, this does not often affect the control measures to be adopted against the scale insects. For the greater portion of the area the measures recommended for the control of individual species may be adopted, and as conditions often permit of the use of hydrocyanic acid gas fumigation is valuable. Where fumigation is not practicable spraying with oil or, if Maori be abundant, the oil-lime sulphur combination may be used except where pink wax predominates. Against pink wax either the soap and washing soda spray or resin-soda-fish oil may be employed in accordance with the requirements for this species. Pulvinaria and white wax are also to be found in places, generally associated with pink wax, and in such cases the resin-soda-fish oil must be used in the late summer.

and the use of soap and washing soda mixture confined to the early summer for the control of the pink wax. Scab disease is common on lemons and mandarins in this area, and if this disease is to be combated the Burgundy-soap and washing soda combination may then be substituted for the early summer application of soap and washing soda, and the resin-soda-fish oil spray should then certainly be used in the late summer-autumn period.

Palmwoods—Woombye—Nambour.

On healthy, free-growing trees, other than lemons and to a lesser extent grapefruit, in these districts, pink wax is invariably the outstanding scale pest. Mussel scale is also commonly found, but if the orchard be well tended this species is usually confined to the fruit in pest proportions. Where concurrent control of these pests is desired the resin-soda-fish oil mixture should be employed. The time of application will ordinarily be dictated by the requirements for the control of pink wax. It will generally be necessary to use soap and washing soda in the early summer for the control of that brood of the pink wax. The presence of scab, particulauly on Beauty of Glen Retreat mandarin trees, may necessitate the use of the Burgundy-soap and washing soda combination in the early summer, but this is unlikely, as usually the time of application of the fungicide will not coincide with that for the scalicide. Melanose and black spot are also prevalent in the district, and if for any reason the continued used of Bordeaux or Burgundy is required the resin-soda-fish oil spray should be used for the control of all scale species. The time of application of this spray will usually be in conformity with the requirements for the dominant scale species, but at times the bronze orange bug may be prevalent and this may necessitate some change. Except where pink wax is the important scale pest this will not matter greatly, for the spray will give quite good results against all other scale pests if applied at the time required for the control of the bug. If the pink wax be very heavy and the period of control far removed from the time of application for the bug, it may be necessary to use soap and washing soda in addition to the resin spray, but this is a rather unlikely happening.

Where red scale is persistently present in large numbers on orange and mandarin trees in this district, the health of the trees needs attention and this should be the first step in the control of the pest. Artificial control may generally be accomplished by the use of straight oil, or if the Maori be prevalent late in the year oil-lime sulphur combinations may be used with good effect. White louse should be kept under control in this district, and the normal method of control for this pest should be regularly employed.

Blackall Range.

The Blackall Range district is somewhat akin to the Tamborine Mountain area, but a greater proportion of the orchards on the Range are protected from the strongest winds, and though winds are constant they are of less importance here than in the Tamborine area. For the most part well-tended orchards on the Range are not troubled to any extent by scale pests, and in general it will be found that if the resin-soda-fish oil spray be applied as recommended against the bronze orange bug nothing further need be done towards the control of the scales. As the spray forms no harmful combination with residue left after Bordeaux

spraying, the occurrence of black spot and melanose will not ordinarily have any bearing on the control of scale insects. Pulvinaria and mussel are the dominant scale species, and though the former is at times the more numerous the latter must be considered the more dangerous. In isolated parts pink wax sometimes occurs in pest proportions and thus may call for special attention. In such cases the recommendations made for the control of pink wax as an individual species hold.

Nambour to Gympie.

Generally speaking pink wax is the most important species of citrus scale insect in the smaller citrus-growing areas between Nambour and Gympie and in the Mary River Valley. Red scale, however, is rather abundant in parts, and if the trees be situated in humid parts mussel scale quickly takes advantage of lax cultural operations. For the most part the recommendations made for the Palmwoods-Woombye-Nambour area apply to this district, but in the latter fumigation is practicable in many places and should be employed when and where effective.

Burrum.

Pink wax is the outstanding scale pest of the Burrum district. Mussel scale is also very prevalent and commonly follows up the injury done by the wax species. When these two pests alone are to be considered, fumigation in the early summer followed by oil-soap-washing soda combination or the resin-soda-fish oil spray in the late summer or autumn months is the most useful treatment. If the mussel scale is not to be considered the spraying may be made with soap and washing soda straight, but if the mussel scale predominate it is better to use the resin-soda-fish oil. In this district the late summer spray application is very commonly done much too early, with consequent poor results. The presence of brown spot disease on the Emperor of Canton mandarins may complicate the position by rendering fumigation impossible. In this case the Burgundy-soap and washing soda, or soap and washing soda spray may be substituted for the fumigation and then the late season application should always be one of the resin-soda-fish oil mixture. Straight oil sprays are often used in this district, but these sprays have little value here, and growers who use them extensively would, for the most part, be well advised to discontinue the practice. White louse is prevalent in the Burrum district, and lime sulphur should be used annually at the time recommended for the control of that scale.

Rockhampton.

Fumigation should generally be employed in the Rockhampton district, particularly in those parts where red scale is the dominant scale pest. The occurrence of the larger horned citrus bug may necessitate the use of fumigation a good deal earlier than it is recommended for use against the red scale. The subsequent treatment for red scale and its common associate in these parts—circular black scale—will depend to a very large extent on the seasonal conditions. If the weather remain hot and dry it is probably that the red scale will breed so rapidly and successfully that further combative measures may be necessary. It is in such times as this that the bug is most in evidence and that a second treatment is called for against that pest. If this be so there will be no need for any further special treatment for the scale insects. If the weather change early in the year, ordinarily the

red scale and the bug will both be quite effectively controlled by the one fumigation, but in such times in this district mussel scale may quickly assert itself. If this happen use should be made of the resin-soda-fish oil spray as soon as conditions permit, or if the mussel scale infestation be lighter oil-soap-washing soda may be used. Because an early fumigation for the bug has apparently given fairly satisfactory results orchardists cannot assume that no further treatment is necessary, and it is still always advisable to examine the trees carefully during March and ascertain the exact position with respect to red scale. If this be not done and the red scale position taken for granted, it may mean that a control will be found necessary early in the following summer, and this is to be avoided for reasons given in earlier paragraphs in connection with the control of red scale as an individual species.

In cases when the March examination suggests that the early (January) fumigation has not reduced the infestations to a point which ensures low populations during the following spring and early summer, a further treatment should be given before the winter. Fumigation may be again employed. More commonly spraying will be preferred and in this event oil, oil-soap-washing soda, or resin-soda-fish oil may be used according to whether there is any complication. If red scale alone be of importance straight oil will be quite satisfactory.

On occasions the occurrence of a fungal disease, which requires the use of Bordeaux mixture for its control may prejudice the use of fumigation or oil spraying. It is important that before Bordeaux is used the trees should be as free of scale as possible. To ensure this it may be necessary to use fumigation in the winter prior to the first application of the fungicide. The trees from then on must be given as good treatment as possible, and in the late summer or autumn months the resin-soda-fish oil spray must be used for the control of the scales. It is important that the trees be kept well watered and not allowed to suffer any more than can be avoided from dry weather conditions. Owing to the probability of high temperatures prevailing even as late as the end of March, the use of the resin-soda-fish oil spray or perhaps oil sprays will possibly be rather later than would otherwise be the case and this point must be borne in mind.

White louse must be kept under control in this district, and even if fumigation be practised it is advisable to use lime sulphur in the late winter as recommended for the control of this pest. The occurence of scab may affect the situation a little, particularly in the case of lemons. Generally, if the infestation be light, lime sulphur is substituted for the first application of Bordeaux, but this almost certainly leads to a loss in fungicidal effect, and cannot be recommended against heavy scab infestation. If the amount of scab be large it is better to confine the lime sulphur application to the trunk and main limbs, and use the Bordeaux on the outside only for the first spraying. The second application of Bordeaux will not be influenced by the previous use of lime sulphur.

In isolated parts of the Rockhampton district pink wax and the long soft scale are common almost to the exclusion of red. In general these species may be combated in the manner recommended for the normal control of individual species. Mussel scale may be associated with these others, and this may necessitate the use of the resin-soda-fish oil spray if fumigation is not to be employed.

Yeppoon.

Pink wax and mussel scale form the most important pest combination in the Yeppoon district, and generally there is no other pest which will interfere with the adoption of the normal measures for combating those scales—i.e., the use of soap and washing soda at the time of appearance of the first brood of the pink wax followed by the use of oil-soap-washing soda or the resin-soda-fish oil spray in the late summer. The occurrence of the black passion bug, *Leptoglossus bidentatus* Montr., as an occasional migrant in large numbers to citrus may mean that it is much better to use the resin-soda-fish oil spray than the oil-soap-washing soda combination. Melanose is rather common in this district, and this may mean that the variation recommended for the Palmwoods-Woombye-Nambour district may be of value.

Byfield.

Pink wax is usually almost the sole scale insect of any moment in the Byfield area, and in normal years it reaches greater intensity in this part than in any other commercial citrus district in the State. Mussel scale may be associated with the pink wax, but the seedling trees, which are so commonly grown in the Byfield district, appear to harbour less mussel scale than might be anticipated. The normal method of control as recommended for the control of pink wax alone will usually be applicable in Byfield. The fly speck fungus, *Leptothyrium* sp., is at times prevalent in the district, and for this reason the use of resin-soda-fish oil spray may be more desirable than the soap and washing soda spray.

Gayndah.

The Gayndah district is very similar to the Rockhampton one, except that mussel scale is much more uncommon in the former. The climates are similar, and the pests, other than scales and diseases, are common to both. Reference should therefore be made to the recommendations for the Rockhampton district.

Lockyer.

On the whole pink wax is the most important scale insect of citrus in this district. Mussel scale and circular black are also very common in places, and in dry times red scale quickly becomes abundant. Fumigation is usually practicable in this district, and its use is to be recommended in general. Pink wax will usually be associated with mussel scale, so that if fumigation is not to be employed the recommendations for the control of this combination as made for the Palmwoods-Woombye-Nambour district should be adopted. Red scale and circular black may be attacked with oil sprays or, if Maori be prevalent, the combination of oil and lime sulphur may be employed if conditions permit.

Black spot and melanose are rather common in parts, and if this be the case reference should be made to the recommendations made for the Burrum district.

Esk.

In this district fumigation is to be recommended. The general position here is similar to the Lockyer area, though red scale is more common in the former district. In general pink wax will be found in

pure colonies, and the red and circular black mixed on other trees. In such cases the recommendations made for the control of individual species will apply. When complications occur reference should be made to what has been given for the Nambour-Palmwoods-Woombye district or the information given under Rockhampton may be of value.

Roma and Far Western Districts.

In inland districts, such as Roma, red scale is the outstanding scale pest in normal times, and as conditions permit of fumigation this should be practised. A special reference to the control of red scale in such districts is included in the discussion on the control of that species as an individual pest. The larger horned citrus bug may cause modification of the procedure in the same way as given in connection with the Rockhampton district. For general purposes reference should be made to what has been written on Rockhampton.

NOTES ON EXPERIMENTAL WORK.

What follows is a brief outline of the methods used in the course of the investigations in procuring and using data.

Life History Breeding Work.

The data concerning the life history of each species were obtained in the following manner, except where has been mentioned otherwise in the text:—Adult females about to reproduce young were kept in the laboratory. In the first place, as the young emerged these were removed each day until sufficient young emerged on one day to commence a large enough colony. When these large batches were present they were transferred to a leaf either by gentle shaking or with the aid of a single fine hair. In the cases of pink wax, hemispherical, mussel, cottony cushion and white louse, the young transferred were definitely not more than nineteen hours old—i.e., 5 p.m. to 9 a.m.—but in the case of white wax, red scale, and circular black scale, owing to the habit of the young of remaining beneath the female for some time after emergence and the great difficulty of obtaining them without injury before they crawl out of their own accord, the young were collected as they emerged naturally from under the mother scale. In these cases the times were taken from the emergence from beneath the mother to that time in the following generation. As soon as the young were placed on the leaf this was fixed on a small tree known to be free of scale. The leaf was so placed that the young had to crawl from it on to the tree, and thus the number of injured young in the colony was greatly reduced. After infestation in this manner the experimental tree was enclosed in a cage of finewire gauze, and thus shielded until such time as chance arrivals from outside sources could be recognised. After that time the gauze was removed and the tree left entirely unprotected, and thus under quite natural conditions. In each case the tree used was of a variety commonly found to harbour the species in the orchard. Thus pink wax was bred on Emperor of Canton, red scale on Late Valencia and lemon (fruit hung on tree), hemispherical scale on Beauty of Glen Retreat and Late Valencia, Pulvinaria on seedling orange, white wax on seedling orange and Scarlet mandarin, white louse on Glen Retreat and seedling orange, circular black on seedling orange and lemon, mussel scale on seedling

orange and Late Valencia, Cottony Cushion on Late Valencia and seedling orange, and soft brown on Scarlet mandarin and Joppa. The number of individuals in each colony was between 200 and 1,000. Observations were carried out with such frequency as was suggested as necessary by the development. Thus, as maturity approached, observations were made daily. In addition to inspection of the whole colony on the plant as muturity approached, a number of individuals were removed each day and examined in the laboratory. The number thus examined varied from five to ten daily up to the time that eggs or, in the case of viviporous species, young were becoming numerous. For this work, as far as possible, the most forward individuals were selected. The females were gently lifted slightly in the first place to ascertain whether or not reproduction was under way. If reproduction was found to be in progress the examined females were removed. The periods given as the developmental ones are the periods occupied by the greatest number of individuals and are not averages of the times taken by all the individuals. The second and subsequent generations were started as follows:—In each case a new tree was used. With pink wax, white wax, circular black, hemispherical, and Pulvinaria scales, old females beneath which were crawling young were placed on the new tree at the time of greatest reproductivity for the previous colony. These females were allowed to remain on the tree for twenty-four hours, and then were removed. In the cases of red, mussel, and white louse, the number of young produced by any one female in twenty-four hours was too small to permit of this method being used. With these species the procedure described for the establishment of the original colony was repeated at each generation, the females of the previous experimental lot being used to provide the young.

Whilst these experimental colonies were under observation specimens from each of the following districts were examined at short intervals:—Howard, Burrum, Montville, Mapleton, Palmwoods, Gatton, and Gayndah. These specimens were selected by various orchardists as being typical of the scales in their orchards at the time of forwarding. The interval at which these specimens were forwarded varied with the state of development of the scales from two months during the winter to one month in the summer and ten days at the time of reproduction. The data obtained from these specimens were tabulated against that from the experimental colonies at Nambour. Visits were made to each of the centres mentioned, and others at irregular intervals throughout the investigation, and in this way a check was kept on all specimens.

Tests of Scalicides.

In testing the scalicidal value of the various materials the following methods were employed:—In the cases of slow breeding species, such as Pulvinaria and white wax, direct counts were made, the only point being that the insects counted were confined to parts that would be readily reached by the spray. In the case of pink wax, migration is such an important factor that the procedure must be varied a little. In this case, from every tree twenty to thirty leaves were taken and the average number of living young per leaf computed. As soon as possible after this the application was made, and as soon as the living and dead

scales were easily differentiated a second count was made. The following figures from one experiment will show the results obtained in this way:—

First count	26th April, 1934
Sprayed	29th April, 1934
Second count	12th May, 1934

Young scale only counted. Practically 100 per cent. of old scales dead in all cases.

Sprayed trees—

Average living young at first count	10·5
Average living young at second count	·26

Unsprayed trees—

Average living young at first count	12·0
Average living young at second count	14·0

Percentage improvement due to spray, 97·99 per cent.

The percentage improvement is calculated in the following way:—The average number of young on the unsprayed trees had increased from 12·0 to 14·0; so that, assuming the same conditions on the sprayed trees, apart from the effects of the spray, the 10·5 average on these would have become 12·25. Thus the trees have improved from 12·25 to ·26, or 97·99 per cent.

With red, Circular black, and mussel scales counts were made, and the averages computed on all trees immediately before the application and six weeks later. The experiment quoted in the section "The Importance of Time of Application" gives the results of this method. In that experiment it will be seen that the scale on the unsprayed trees increased from 24·45 to 416·6, whilst on the sprayed trees the average decreased from 31·5 to 16·8. Assuming the same conditions for all trees except in so far as the application of the scalicide is concerned, it will be seen that in the interval the 31·5 scales of the sprayed trees, if unmolested, would have increased to 536·7, whereas actually the average was only 16·8, or but 3·1 per cent. of this total. Therefore it is assumed that the spray had had a lethal value of 96·9 per cent.

The six weeks' interval was chosen, as it was found that counting within a shorter interval than that did not always give quite reliable data, due, no doubt, to the comparatively small number of scales which can be handled in a reasonable length of time. By waiting for six weeks the position is much more clear, for in that interval many of the dead scales have fallen, and those which remain on the tree are quite easily distinguished from the living. This method is, of course, only possible for species with which migration is not a factor. The fact that reproduction is constant and rapid is an advantage, in that the increase tends to magnify the differences between sprayed and unsprayed trees without altering their absolute relations.

In laying out the experimental plots, trees of one variety in as compact a block as possible were used. Thorough examination of the trees was made in the first place to ensure that scale infestations and general conditions were comparable. In determining which trees should be used as checks and which given particular treatments, a method of randomisation involving the use of two series of numbered pellets was

used. In making all counts, only parts of the tree easily accessible were taken into consideration. These tests were, for the most part, concerned only in determining the lethal value of the materials.

In testing the value of actual treatments, it was assumed from the work in other countries that hydrocyanic acid gas would probably give satisfactory commercial control lasting not less than twelve months. The problem then became essentially one of discovering just when the fumigant should be applied. The experiments then were ones of trial and error, using the facts concerning the life history and habits as these became known. In this way each part of the investigation helped to elucidate data for the other. It has not been possible to test every brand of spray over a full twelve months, but it is reasonable to assume that if hydrocyanic acid gas gives a kill of 99 per cent. and a spray of 96 per cent. "kill," the controls will be, roughly, in the proportion of 99:96 provided both are applied at the same time.

SUMMARY OF INVESTIGATIONAL WORK.

1. Fourteen species of scale insects are recorded as attacking citrus in Queensland. Two of these species are recorded for the first time as pests of citrus in this State. *Pulvinaria cellulosa* Green appears to be a new record for the State, and *Paralecanium expansum* Green, though previously recorded from *Ficus macrophylla* Desf., has not previously been found on citrus. The evidence obtained throws doubt on the occurrence of *Lepidosaphes gloveri* as a pest of citrus in Queensland.

2. The economic status of the group and of each species and the factors tending to magnify or minimise the importance of each species are discussed.

3. The seasonal life history and habits of each of the important species have been studied and recorded.

4. Questions dealing with the natural enemies have been investigated, and notes are given on the more important species of these. With only one species—*Ceroplastes rubens*—it is considered that the introduction of further natural enemies is likely to be attended by worthwhile results.

5. The control of individual species has been the subject of experimental work, and the conclusions arrived at are given.

6. Special attention has been given to ways of combating the common complexities of pest and diseases which include scale insects.

7. The resin-soda-fish oil spray has been the subject of much work, and it is concluded that though the spray is somewhat cumbersome to prepare it is a most valuable scalicide, particularly in those cases where copper containing fungicides must be used. Apart from its use under these circumstances, the spray has proved itself very little inferior to hydrocyanic acid gas as a scalicide.

8. Special attention has been paid to oil sprays. It is concluded that with the introduction of the highly refined white oils much of the objection to the use of oil on citrus is overcome. The discontinuance of the general use of red oil is advocated. It was found that oil sprays are used very often quite wrongly, and growers are advised to use this class of spray only when they are certain that the desired result will be obtained.

9. Questions concerning the mixing of two sprays and following of one spray by a second have been investigated, and for the most part the results given were obtained in experiments on commercial orchards.

ACKNOWLEDGMENTS.

By forwarding regular supplies of specimens, and from time to time carrying out tests with sprays or fumigants, the following have rendered much assistance and thanks are tendered to them:—Messrs. J. W. Howie, Horticulturist, Queensland Agricultural High School and College, Gatton; J. L. Smith and S. Remmington, Palmwoods; W. Duggan, senr., Burrum; C. E. Farmer, Howard and R. A Ulcoq, Gayndah The writer is particularly grateful to Mr. F. C. Robinson, of Gayndah, who throughout the work placed almost his entire orchard at his disposal for experimental work and assisted in many other ways also.

Mr. R. L. Prest's co-operation in fumigation and spraying experiments was much appreciated. Thanks are also tendered to Mr. Helmsing for his illustration work, and to those members of the entomological staff who assisted on all possible occasions. The identification of all Chalcid wasps was made by Mr. A. A. Girault, and the pathological section supplied determinations of the entomogenous fungi.

To my Chief, Mr. Robert Veitch, I am also indebted for much valuable advice and criticism.

REFERENCES.

For further information concerning those insects and diseases mentioned as having bearing on the control of scale insects, growers are referred to the following publications of the Department of Agriculture and Stock, Division of Entomology and Plant Pathology:—

Melanose, Black Spot, Scab — Pathological Leaflet No. 8, by J. H. Simmonds.

Larger Horned Citrus Bug—Bulletin No. 8, by W. A. T. Summerville.

Bronze Orange Bug—Entomological Leaflet 18, by W. A. T. Summerville.

Maori Mite—Advisory Leaflet 6, by W. A. T. Summerville.

The following is a list of the principal works consulted:—

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SEAT FOR THE HARROW.

A harrow having no seat can be provided with one, as shown in the drawing. The seat support is made of 1-inch by 6-inch and 2-inch by 6-inch wood, securely nailed together as indicated in the lower right-hand detail. Two holes are drilled through the lower end of the 2-inch by 6-inch uprights to accommodate the axle of an old wheel, which can be taken from some discarded implement. Parts of an old cultivator, with collars and a brace added as shown, is used as an axle for the wheel.

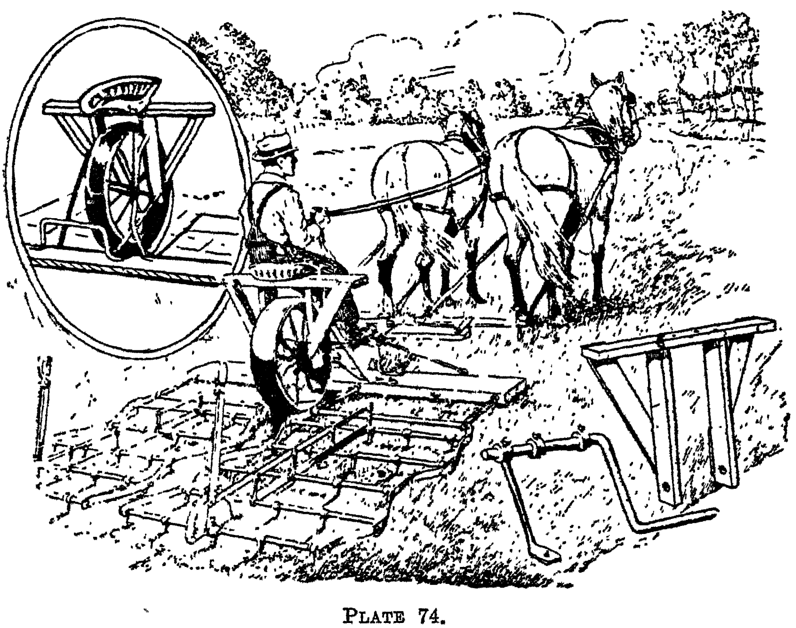

PLATE 74.

It is securely fastened to a 2-inch by 6-inch "draw plank," which is attached to the front of the cultivator. Additional flat-iron braces are provided to hold the seat support rigidly to the draw blank, and a foot-rest, made of ½-inch iron rod and bent to the shape indicated, is also attached to the draw plank. An iron seat from a discarded implement is fastened to the support in the most convenient position for the driver. In use, the wheel rests on the ground, and when the horses are walking the draw plank is raised from 2 inches to 4 inches, while at the standstill it rests on the ground.

Parasites of the Pig.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

THE principal external parasites of the pig include lice and mites, the latter being responsible for mange conditions.

Lice (*Hæmatopinus suis*).

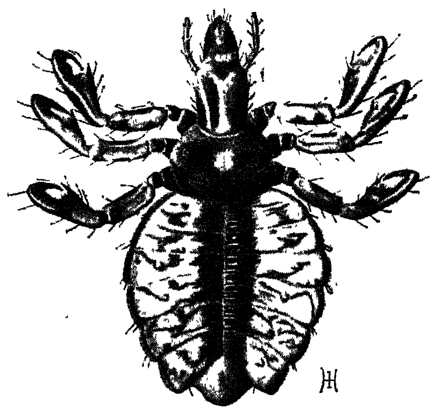

PLATE 75.—PIG LOUSE (*Hæmatopinus suis*). Ten times natural size.

Pig lice, *Hæmatopinus suis,* are found everywhere in Queensland where pigs are reared. The species is one of the largest lice known and may measure up to one-quarter of an inch in length. The male is smaller than the female and may be readily distinguished by the presence of a black streak on the underside of the abdomen. The mouthparts consist of a proboscis or beak with which the louse is able to pierce the skin and suck up blood. This continual puncturing of the skin causes considerable irritation, which may in time so lower the vitality of the animal as to produce an unthrifty condition and render it more susceptible to attack by other parasites and diseases.

Life History.

Eggs deposited by the females are glued to the bristles of the pig and hatch in from 12 to 20 days, usually in about 14 days. The young louse is very similar in appearance to the adult, differing mainly in size. After hatching, the young lice immediately commence feeding, and after 10 to 12 days become mature. Lice may live as long as 35 days and during her lifetime the female lays about 90 eggs.

Mites.

Two species of mites infest the pig, each of which is responsible for a condition of mange. One species causes Sarcoptic mange, the other, Demodectic mange.

Sarcoptic Mange (*Sarcoptes scabiei suis*).

Sarcoptic mange or common mange is caused by the mite *Sarcoptes scabiei suis.* This mite is very small, at most only one-fiftieth of an inch long, and whitish in colour. The body is rounded with four pairs

of short thick legs, and provided with a number of short backwardly projecting spines on its upper surface. The parasites live in galleries under the skin in which the female lays her eggs. These eggs hatch in 3 to 10 days and after another 10 or 12 days, the young mite becomes sexually mature. There is thus a new generation produced at least every 13 days.

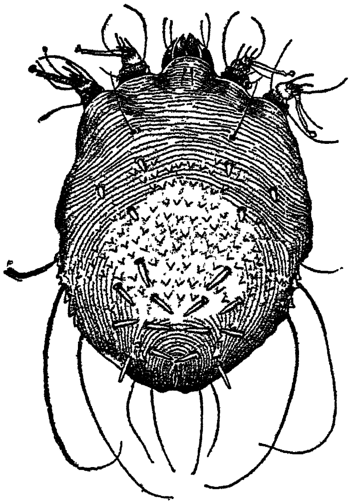

PLATE 76.—SARCOPTIC MANGE MITE.
Female. Magnified 100 times.
[*From Farmers' Bulletin* 1085, *United States Department Agriculture.*

Symptoms of Sarcoptic Mange.

The burrowing of the mites through the skin causes the skin to become inflamed and swollen. At first, these inflamed areas are very minute, but in time become very conspicuous and as the mites increase the lesions gradually coalesce. The irritation causes the animal to rub itself against any convenient object, the areas become raw and bleeding and large scabs are formed. The movements of the pig causes a continual breaking of the scabs and blood and serum ooze out from the cracks. The bristles on the affected area fall out and eventually only a few or none remain. Later the skin becomes hard, thickened, and thrown into folds. In severe cases the animals affected become weak and emaciated and unless treated may die.

In the early stages of the disease the lesions usually occur on the head, around the eyes, ears, and nose, and from here the disease spreads along the neck and shoulders until the entire body may be affected.

Demodectic Mange (*Demodex phylloides*).

This type of mange is caused by a very minute worm-like mite, *Demodex phylloides,* and is much less common than Sarcoptic mange. The mites of Demodectic mange are microscopic in size, measuring up to one one-hundredth of an inch. They spend their entire life in the hair follicle or sweat glands, and when in numbers cause well-marked lesions. These lesions usually appear first on the snout or around the eyelids and from there spread slowly over the throat, breast, abdomen, and other parts of the body where the skin is soft and thin. The effected skin becomes reddish and scurfy with numerous small hard nodules. These nodules eventually break and discharge a creamy pus, and many of them may run together to form suppurating cavities.

Diagnosis of Parasitic Mange.

The pig at times may be subject to many various skin diseases, and for an accurate diagnosis of Sarcoptic or Demodectic mange it is best to submit samples of scrapings from the affected skin for examination. The scrapings, to include the mites, should be taken from the more recent lesions, and should be made deep enough to cause the appearance of blood. The scrapings should then be placed in a tightly-corked tube or bottle and forwarded for examination.

Control of Lice and Mange.

For the control of lice and mange, crude oil or fuel oil will be found satisfactory. The oil may be easily applied by hand, and owing to its adhesive and spreading qualities only comparatively small quantities are required. In the case of lice, a second application is desirable after fourteen days. For severe cases of Sarcoptic mange frequent dressings are necessary; but tests have shown that a complete cure may be expected provided careful and persistent treatment is given. Before being treated with the oil, the affected animal should be thoroughly scrubbed with warm soapy water.

No specific cure is known for Demodectic mange, but frequent applications of crude petroleum check the disease. Animals not responding to treatment should be killed. Animals oiled with crude oil should be kept in the shade as much as possible until the oil has dried, as contact with the sun is likely to cause blistering.

Hog oilers and medicated wallows and dips are frequently recommended as methods of controlling lice and mange. Hog oilers consist of posts wrapped round with oiled ropes or sacking and placed at some convenient spot, the idea being that the pigs will rub themselves against the post so that a small quantity of oil is deposited on or near the area of skin being rubbed. These devices tend to lessen the spread of lice and mange, but, as the pig will rub against any convenient object, are not to be depended upon to effect eradication or prevent the losses caused by heavy infestations.

By taking advantage of the pig's natural tendency to wallow in water, especially during warm weather, the use of crude oil on the surface of the water will be found satisfactory for the control of external parasites. The wallows should be constructed of concrete, and the water, with its film of oil, should be of just sufficient depth so that the nostrils can be easily kept above the surface of the liquid. For pigs of 40 to 80 lb. weight the depth should not exceed 3 inches, 6 inches being the maximum for the largest pigs. If the depth is too great the animal is afraid to lie down. The wallow should be roofed over to prevent the water becoming too hot. The wallow, moreover, should not be kept oiled continuously, but for short periods every ten days, until the desired results are obtained.

Dipping is one of the most effective treatments for lice and mange. The dip consists of a concrete bath 40 to 48 inches deep, with a total length of at least 7 yards, constructed on the same general principles as a cattle dip. The oil dips are usually considered the most economical and most dependable dips, and of the oils available, crude petroleum is recommended. The dip is filled with water, on which the oil is poured to a depth of 4 or 5 inches.

Attention should also be paid to sanitation. As lice will not live for more than three days off the pig, it is not considered that sties which have housed infested pigs would be a source of danger under sanitary

conditions. It is always better, however, that such sties should be given a thorough disinfection and cleaning before clean pigs are placed in them.

Mange is highly contagious, and pigs showing symptoms of mange should be immediately isolated. Visible lesions of Sarcoptic mange may develop in fourteen to fifteen days; so animals in contact with affected pigs should be isolated for this period. All litter and manure should be cleaned up and burnt and the sties given a thorough disinfection. It should be remembered that Sarcoptic mange is transferable to man; so it is advisable, after handling affected pigs, to bathe and have a complete change of clothing.

INTERNAL PARASITES.

No less than seventeen internal parasites or worms have been recorded from the pig in Queensland, but fortunately many occur only in small numbers and are not of any economic importance.

Flukes and Tapeworms.

In Queensland, flukes are unknown in the pig, except for rare instances when the liver fluke of sheep, *Fasciola hepatica,* has been observed in the liver.

The pig does not harbour any species of adult tapeworm but may act as a host for two larval tapeworms which reach maturity in the dog. These larval forms are known as *Cysticercus tenuicollis* and *Echinococcus granulosus.* Only the latter is of importance, as it is the cause of hydatids, which is a serious disease in man.

In the pig, the larval hydatid usually occurs in the liver and lungs, and consists of a bladder of fluid containing numerous minute white specks. Infestation may be prevented by seeing that the pigs are not given access to the fæces of dogs, by thoroughly boiling all offal before feeding it to dogs, and also by regular treatment of all dogs with an efficient vermifuge to remove the adult worm.

Roundworms (*Stomach Worms*).

Description and Life History.

Four species of stomach worms are known, of which two species, *Arduenna strongylina* and *Physocephalus sexalatus,* may be of some importance. Both these worms are whitish in colour, up to seven-eighths of an inch in length, and are found usually at the exit end of the stomach. Their life histories are similar and very interesting, in that the eggs, when passed out in the dung, are eaten by various dung-frequenting beetles. In these intermediate hosts the eggs hatch and the larvæ undergo certain development. The pig can only become infested when it eats the beetle containing the larvæ.

Control.

Control consists in the daily removal of all dung and the clearing up of all litter, &c., which might afford shelter to the beetles. No efficient drug is known which will remove the parasites, but oil of chenopodium, as recommended for *Ascaris lumbricoides,* might be tried.

The Large Round Worm (*Ascaris lumbricoides*).

This species is one of the largest roundworms known and may grow up to 15 inches in length. The parasite occurs in the small intestine and frequently in very large numbers.

Life History.

The eggs laid by the female worms pass out in the dung, and under suitable conditions of temperature and moisture become infective in about eighteen days. These infective embryos when swallowed by the pig hatch and the young larvæ immediately bore into the intestinal wall. From there they are carried in the blood stream to the liver, and still continuing their migration reach the blood capillaries, and are moved on to the heart, and from there to the lungs. About ten days after hatching the larvæ leave the lungs, move up the windpipe into the mouth, are swallowed, and reach the small intestine again, in which they settle down and grow to maturity.

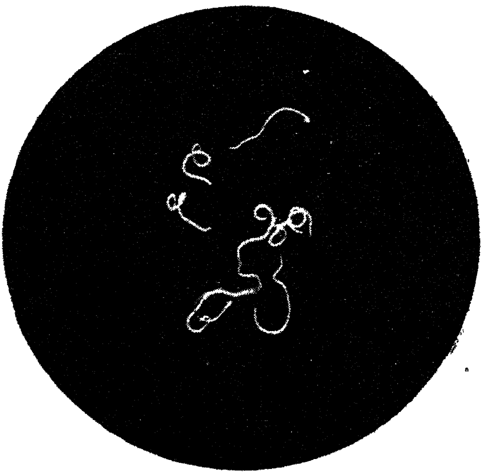

PLATE 77.—STOMACH WORMS (*Arduenna strongylina*). Natural size.

Effect on the Pig.

Only young animals up to four and five months of age are affected by Ascaris infestation. The larvæ burrowing through the liver and lungs cause serious disorders. Lung destruction may result in a condition of pneumonia, which may sometimes be fatal. A heavy infestation means a stunted and sickly animal, which becomes unprofitable. The invasion of the lungs by the migrating larvæ occasionally produces a condition known as "thumps," in which the breathing is laboured and bellows-like. More often, however, destruction of the lung tissue is shown by a short, hard, cough, which is especially prominent after exertion.

Control.

Treatment of infested animals with oil of chenopodium at the rate of 1 cubic centimetre for every 25 lb. weight to a maximum dose of 4 cubic centimetres will remove the majority, if not all, the worms from the small intestine. This drug is given with or immediately followed by castor oil, 1 to 2 oz. being used, depending upon the dose of chenopodium administered. The animal to be treated should be starved for twenty-four hours before and for four hours after the drug is administered. It is not advisable to treat animals under six weeks old. As one dose of chenopodium cannot be depended upon to remove all the worms from every pig, the dose should be repeated after an interval of ten to fourteen days.

Although oil of chenopodium is highly efficient in removing the worms from the small intestine, it is entirely without effect on the larvæ

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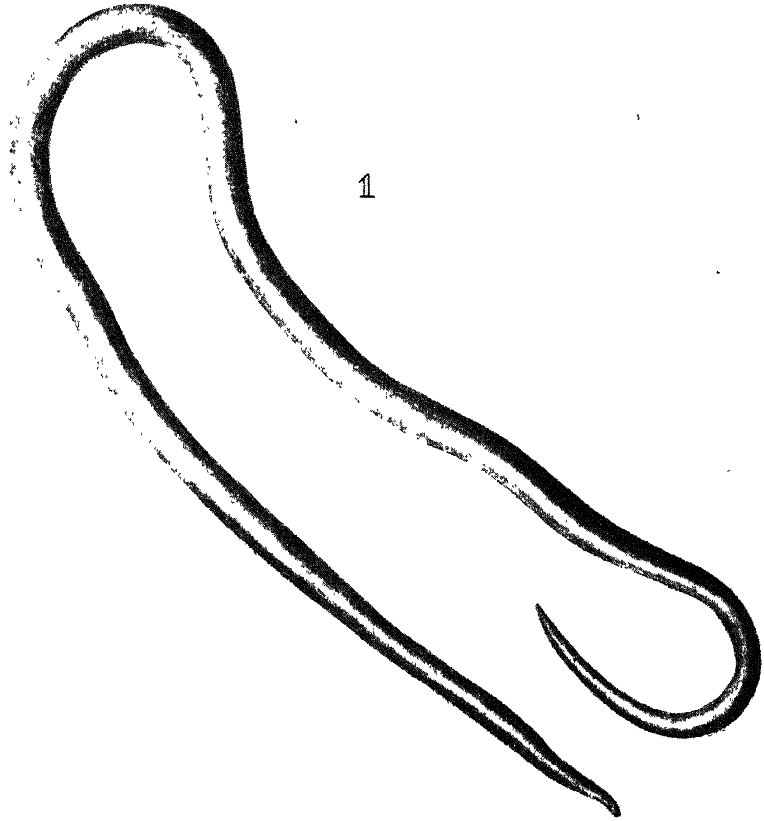

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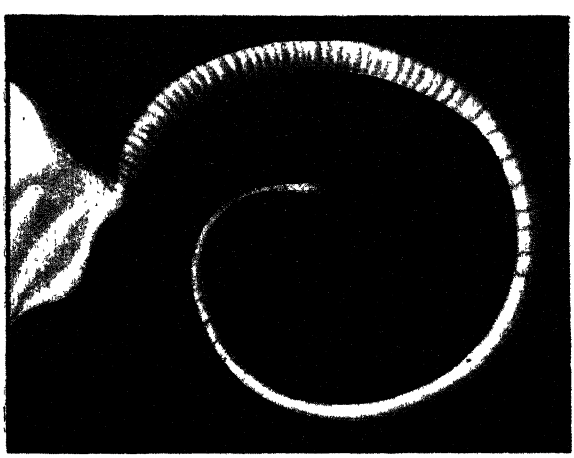


I. W. Helmsing. 1929.

Plate 78.

Fig. 1.—Large Round Worm (*Ascaris lumbricoides*).
Fig. 2.—Thorn-headed Worm (*Macracanthorhynchus hirudinaceus*).
Natural size.

in the liver and lungs, and in order to minimise losses through the presence of this stage in the life cycle, preventive measures must be adopted.

During its lifetime the female worm is said to lay as many as 27,000,000 eggs; and as these are very resistant to adverse conditions,

PLATE 79.

All these four pigs are from the same litter. The two smaller animals are infested with worms. The two larger animals are worm free. Note the differenc in growth.

the sties and yards become so heavily contaminated with eggs that the animals swallow large numbers of infectious eggs every day. Sanitation is therefore the keynote of prevention. Daily removal of all dung, a good drainage system that keeps the yards and sties as dry as possible, the use of pens with concrete floors, and keeping the animals' food off the ground are all necessary for Ascaris control.

A system of pig-rearing in use in the United States has been highly successful in controlling, not only Ascaris infestation, but also infestations with other worm parasites. As Ascaris is harmful only to pigs up to four or five months of age, this method aims at keeping the young pigs away from the old contaminated yards till they reach this age. Certain modifications have been made which it is considered will make this system more practicable and more efficient under Queensland conditions.

Certain of the sties are set aside for farrowing purposes only, and it is essential that these have concrete floors. A few days before the sow is due to farrow the sty is given a thorough and careful cleansing and finally washed down with liberal applications of a boiling five cent. disinfectant solution. Kerol is recommended for this purpose, but in its absence any disinfectant with a high tar acid content, 25 per cent. and over, may be used. Make up the solution, boil, and without any delay apply it to the floor and walls of the pen.

Next, wash the sow with a warm soapy solution, remove all dirt and mud crusts, paying particular attention to the feet and udders. She should then be oiled to keep lice worry at a minimum, a second treatment being given after an interval of about fifteen days. In getting her into the prepared pen, she should be hauled and not driven.

After farrowing the sow and litter are placed either on fresh ground or ground on which pigs have not been running for a number of years. For this purpose three separate pastures are advised, each of which is subdivided. The one to be used by the young pigs should be previously prepared by sowing with a suitable forage crop, and in order to avoid any wastage of land the other two pastures could be given over to some profitable farm crop.

The period spent in the pen after farrowing depends on the number of sows farrowing. If only one or two sows are concerned, they and their litters may be placed in the pasture a few days after birth; but a three weeks' period is advised, for by this time the young pigs will be strong enough not to suffer through any possible robbing by their older and stronger fellows running in the same pasture. During these three weeks spent with the mother in the pen strict sanitation is necessary.

Only one division of the specially prepared pasture should be used, and when weaned the animals could then be placed in the second division, where they are kept till at least four months old. Next year, one of the two other pastures is used for the pigs, thus ensuring that each pasture does not run pigs for a period of two years, during which time it is considered that if proper cultivation practices are adopted very little infection, if any, would be surviving.

In cases where no such pasture land is available, the farmer is advised to remove the top 9 inches to 12 inches of the old contaminated soil from the yard attached to the farrowing pen and replace it with new, clean soil, preferably sand. Only the young pigs should be allowed to use this yard, the exits from the pen being made too small for the sow to pass through. Strict supervision should be given the cleanliness of the pen, which every two weeks should be given a disinfection with a boiling 5 per cent. solution of Kerol.

The Thorn-headed Worm (*Macracanthorhynchus hirundinaceus*).

Description and Life History.

This is also a large species occurring in the small intestine, the female worms attaining a length of 7 to 16 inches. The parasite is whitish in colour, and its head is provided with an armed proboscis with which the worm attaches itself to the intestinal wall.

The eggs are passed out in the dung, and for the life cycle to be completed must be consumed by certain beetle grubs. The eggs hatch in the intestine of the grub, and the young larvæ forcing their way through the intestinal wall reach the body cavity, where they encyst. The pig, in rooting about, finds the grubs and eats them. The encysted worms are released and attach themselves to the wall of the small intestine by means of their proboscis, and eventually reach maturity.

Effect on the Pig.

The thorn-headed worm is fortunately not very common, but moderate to heavy infestations are sometimes seen. The worms are

continually moving about in the small intestine and reattaching themselves, and consequently severe damage to the intestinal wall is occasioned. The infested animal shows evidence of great pain, may be subject to nervous disorders, and rapidly loses condition.

Control.

There is no drug known that can be depended upon to remove these worms, but the treatment as recommended for Ascaris may lessen the infestation. Strict sanitation must be maintained, and anything that will prevent the pig rooting around and eating the beetle grubs should be considered.

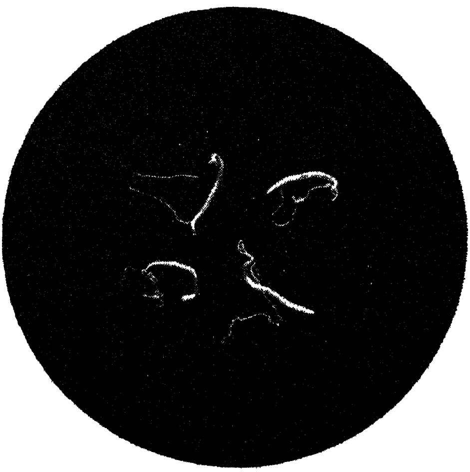


PLATE 80.—WHIP WORM (*Trichuris trichiura*). Natural size.

Whip Worm (*Trichuris trichiura*).

This parasite gets its common name from its resemblance to a whip, the anterior portion being thin and thread-like, and the posterior portion comparatively stout. It is found in the caecum and adjoining portion of the large intestine, and may measure from 1½ to 2 inches in length.

The eggs laid by the females pass out in the dung, and under suitable conditions of temperature and moisture develop into infective embryos. On being swallowed by the pig these infectious eggs hatch, and the young larvæ, making their way to the caecum and large intestine, reach maturity in sixteen to twenty days.

Control.

The whipworm is an exceedingly common species, and it is considered that a heavy infestation may be distinctly harmful. Repeated treatments with oil of chenopodium may give results, but owing to its location so far back in the alimentary tract the worm is difficult to reach with vermifuges. The sanitary measures as recommended for Ascaris should be applied for whipworm control.

Nodule Worms (*Œsophagostomum* spp.).

Description and Life History.

Two species of nodule worms are known, *Œsophagostomum dentatum* and *O. longicaudum*, the latter being comparatively rare. Both

occur in the large intestine, are whitish or greyish in colour, and may measure up to three-quarters of an inch in length.

The eggs, in this case, after passing out in the dung, hatch, and the young larvæ feed in the dung for several days before reaching the infective stage. The larva is now enclosed in a sheath which helps to protect it from adverse conditions. When swallowed by the pig the larva loses its sheath and burrows into the wall of the large intestine, causing the formation of a small nodule. After a period of development in the nodule, the larva eventually breaks out and settles down in the intestine and grows to maturity.

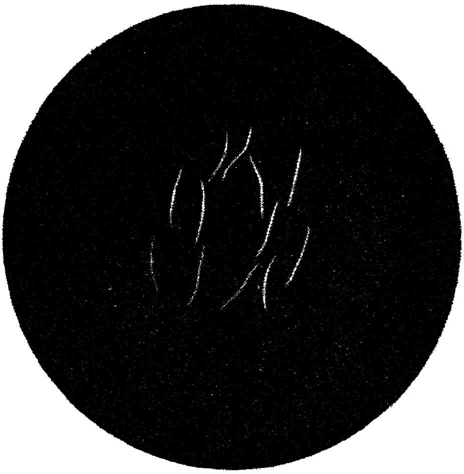


PLATE 81.—NODULE WORM (*Œsophagostomum dentatum*). Natural size.

Control.

Nodule worms are most harmful to young stock, and a heavy infestation may result in general unthriftiness. No treatment with drugs is known to be effective for nodule worm, and the only control measures are concerned with sanitation.

Lung Worms (*Metastrongylus* spp.).

Description and Life History.

Two species of lung worms are known, *Metastrongylus apri.* and *M. pudendotectus.* Both are long, thread-like worms from 1½ inch to 3 inches long, occurring in the air tubes of the lungs.

The eggs which are laid by the females contain active embryos which hatch in the lungs. The larvæ may be swallowed and passed out with the dung, or else may reach the exterior in the nasal and bronchial discharges. Before its development can be completed the larva must now be swallowed by an earth worm, the pig becoming infected when it in turn eats the earth worm.

Effect on the Pig.

A light infestation causes no appreciable harm, but when in numbers, and especially in young pigs, the worms may cause a bronchitis char-

acterised by a short, husky cough, and sometimes followed by pneumonia. The infested animals rapidly lose condition and, if bacterial complications arise, may die.

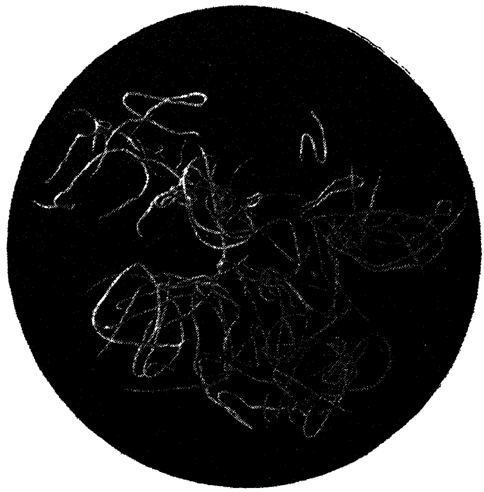


PLATE 82.—LUNG WORM (*Metastrongylus apri*). Natural size.

Control.

Should an outbreak occur, the unaffected pigs should be immediately removed and the infested animals given good, clean water, nourishing food, and warm quarters. Good nursing is the best treatment for lungworm infestation. All conditions permitting the presence of earth worms must be attended to, and sanitation again is necessary for an efficient control of these parasites.

Kidney Worm (*Stephanurus dentatus*).

Description.

This parasite is given the popular name of kidney worm because it is found in the vicinity of the kidneys. Mature worms are seen in the flare fat and occasionally in the kidneys themselves, while young stages

PLATE 83.—KIDNEY WORM (*Stephanurus dentatus*).
(*a*) Three times natural size. (*b*) Natural size.

of the parasite, whilst most prominent in the liver, may occur in the lungs and various other parts of the body. The kidney worm has a very distinctive mottled appearance, is relatively stout, and may grow up to 2 inches in length.

Life History.

Only those females inhabiting the kidneys or kidney fat are sexually mature, and these lay eggs which eventually reach the exterior in the urine. The eggs hatch in one to two days, and five to eight days after hatching the young larvæ are ready to infest the pig. As in the case of the nodule worm, the infective larva is enclosed in a sheath. The pig becomes infected by swallowing these infective larvæ, or infection may occur through the larvæ burrowing through the skin. In any case, the young worm eventually reaches the liver, where it remains for some months. After a period of five to six months the worms are mature, and leaving the liver migrate to the kidney fat, where, if females, they commence to lay eggs.

Effect on the Pig.

Heavy infestations result in an unthrifty animal, owing mainly to the extensive damage to the liver caused by the young worms. It is one of the most widespread parasites of the pig in Queensland, and is certainly a cause of serious wastage. The condemnations of pigs' livers and infested carcasses for export purposes and the unthriftiness of infested pigs is regarded as one of the most serious economic losses the pig industry in Queensland has to contend with.

Control.

Owing to their location in the vicinity of the kidneys, these parasites cannot be removed by drugs given via the mouth, and only preventive measures will bring about a satisfactory control.

As the eggs and larvæ are rapidly killed by sunlight and dryness, yards and sties should be efficiently drained and kept as dry as possible. All depressions and mud holes, especially those in the shade, should receive attention, and if these cannot be kept dry they should be sprayed weekly with a 5 per cent. Kerol solution at the rate of 10 gallons of Kerol per 100 square yards. Sties should be built of concrete, or else have slatted floors, which allow the urine to drain through to the ground beneath. All litter should be constantly cleaned up, as the soil so protected forms one of the most favoured sites of the infective larvæ. Yards and sties spelled for six months may be used with safety, as larvæ cannot survive for this period, even under optimum conditions.

The system used for Ascaris control may be applied here with certain modifications. The pastures are prepared as already stated, ploughing and cultivation being very efficient in cleaning the land of infection. The food and water troughs in this case, however, are placed on bare, well-drained areas. The food troughs may be shaded, but the surrounding bare areas must be well exposed to sunlight. After feeding or drinking, the majority of the urine is then passed on this bare exposed land, and the eggs and larvæ are rapidly killed by the sunlight and dryness. Paths used by the pigs throughout the pasture should also be kept bare and well exposed.

SANITATION.

It has been aptly remarked that the harm resulting from worm infestation in pigs would be considerably reduced "if pigs were kept in a less swine-like manner." Without sanitation little can be accomplished in the control of any parasite. Even though treatment with a drug may be depended upon to remove all worms, there is little advantage in its use if the animals are able to become reinfested immediately after

wards. So far as the pig is concerned, prevention assumes an especially prominent place in worm parasite control, for there is only one species for which an efficient vermifuge is known. This species is *Ascaris lumbricoides,* and even here treatment is of no effect against the more harmful phase in the life cycle—namely, the migrating larva. This point emphasises the need of good sanitation, which, by the elimination of conditions favouring the development of the life cycle stages spent outside the pig, considerably reduces the chance of infestation. The principals of good sanitation are outlined herewith:—

1. *Sties.*—In the construction of a sty the farmer should aim at concrete floors. The initial expenditure may be high, but the result is shown in the ease with which such sties may be kept clean and the subsequent good health of the pigs. Earthern floors in sties should be entirely abolished, as it is impossible to keep them clean and dry.

2. *Dung.*—All dung should be removed daily. The dung carries the eggs of those parasites inhabiting the alimentary canal, and its regular removal and disposal is important. If desired for fertilizing purposes, it should be spread out immediately in the pastures. It must be understood that pastures so treated should not be accessible to the pigs; otherwise the dung should be buried under 1 foot of soil. Pig dung is a favoured breeding medium of the house fly, which, when in numbers, not only becomes an annoyance to the animals, but also plays a very prominent part in the spread of disease. The proper disposal of the dung is important from this aspect also.

3. *Drainage.*—Moisture is a necessary factor for the development of the free living stages of all worm parasites, and in its absence very few of these can survive for any length of time. A good drainage system is therefore an essential for good sanitation, and the progressive pig raiser will see that all depressions are filled in and that mud holes are not permitted. If wallows are considered necessary, they should be built of concrete and frequently cleaned out and disinfected.

4. *Feeding.*—No food should be thrown on the ground, but supplied in sanitary food troughs. These are best built of concrete, evenly divided by round iron cross pieces, to prevent the animals lying in them. In yards, such food troughs should be surrounded by a concrete floor raised above the level of the ground and sloping away from the trough. Hoppers are advised for dry rations.

5. Keep the runways and yards as free of litter as possible. Accumulations of corn cobs, &c., protect any infection in the soil beneath from such adverse conditions as sunlight and dryness.

THE ADMINISTRATION OF VERMIFUGES TO PIGS.

It must be remembered that the pig has a peculiar narrow throat, and great care must be taken when administering drugs. With liquids the danger is somewhat increased, as they are apt to enter the lungs and suffocate the patient. Oil of chenopodium and castor oil may, however, be administered quite safely if the directions given below are carefully followed. The required amounts of the drug and castor oil are measured out and thoroughly mixed. Young animals are set up on their tail and

between an assistant's legs, the mouth opened by a spreader or gag, and the vermifuge administered very slowly over the back of the tongue by means of a syringe with a long curved nozzle (Plate 84, fig. 1). *The liquid should be given slowly and ample time given the animal to swallow.* Care should be taken not to force the head up too far.

Animals too big to be handled in this way are best placed in a crate or crush. A leather strap is used to elevate the upper jaw and bring the mouth level with the shoulder tops, the drug being then administered with the syringe in the manner described above. Failing a syringe, an old boot from which the toe has been removed is occasionally used for

PLATE 84.—DRENCHING A PIG FOR WORMS.

administering liquids; but with the syringe the work is quicker and each animal is given a full dose.

Oil of chenopodium may also be obtained in capsules. It is not always an easy matter, however, to dose pigs with capsules, and as, in any case, the capsules would have to be followed by castor oil, it is considered that the simultaneous administration of the drug and castor oil is much easier for the operator.

The administration of chenopodium in food is sometimes recommended, but cannot be considered as nearly as efficient as individual treatment with the syringe.

The Control of Insect Pests of Sugar Cane.

By R. W. MUNGOMERY.

IN common with almost all other plants, sugar-cane is attacked by a number of insects, the combined effect of which tends to weaken the plant and prevent to a greater or less degree the full functioning of its roots, stalks, and leaves. Thus, to cite a few examples:—"White grubs" attack the roots and underground portions of the stalk, and deprive the cane stool of its means of maintaining its normal supply of plant foods and water. Borers feed on the more succulent internal fibres of the stalk and interfere with the ready circulation of sap between roots and leaves. At the same time the tunnels of these borers, having access to the outside air, provide an easy entrance for certain fungi which cause serious internal rots. Caterpillars and grasshoppers at times consume almost the entire leafblades which are the "factories" wherein the cane sugar is manufactured. Evidently, therefore, any serious attack by an insect results in a curtailment of the plant's activities, and this is automatically reflected in reduced crop yields. It is true that the effect of some insects found attacking cane is almost negligible, whilst others, although potentially dangerous, are never present in sufficiently large numbers to cause noticeable damage. However, when insects become so abundant as to compete seriously with man in his efforts to raise crops, they then become pests, and some form of control must be instituted against them to prevent or restrict their damage.

The fundamental principles of insect control can be considered from four main standpoints, and these will be reviewed in their possible application to the control of sugar-cane insect pests. Such control measures may be divided into what may broadly be termed (1) cultural, (2) chemical, (3) biological, and (4) legislative methods.

CULTURAL CONTROL.

Cultural methods of control are such that, by some variation of, or concentration on a particular farm practice, the agriculturist aims at constantly placing the insect pest at a disadvantage, and either minimises or completely counteracts its otherwise harmful effects. Cultural methods of control are those which have been gained from the common experience of man in his fight against the many insect pests found damaging his crops. They may be classed as methods which usually readily suggest themselves and are more or less common knowledge, and for that reason they are most frequently put into operation to combat pests. Some of these farm practices may be summarised as follows:—

Summer Ploughing: It is well known that many soil frequenting insects are located in the upper soil levels during the warmer months of the year, whilst during the cold winter period they are found in a more or less inactive condition usually below plough level. Therefore, if ploughing be carried out during the summer, a much greater check is imposed on these insects than if the same operation were carried out during the winter.

Collecting and Hand-picking: The systematic collection of beetles from feeding trees in compact areas has generally been acknowledged to bring about a satisfactory reduction in the incidence of grubs during the following season; but in broken country, where collecting must of necessity be extensive and, at best, incomplete, the benefits to be derived from this practice are

doubtful. In some of the Southern areas boys are employed to follow behind single-furrow ploughs and to collect any grubs that may be exposed in the furrows. Provided this work is carried out thoroughly, it is possible so to clean the land that two or three crops may be grown subsequently without any serious grub damage. These remarks apply of course to the grubs with the two year life cycle which is characteristic of the Childers cane grub.

Excision: This form of control is sometimes employed against moth borers in parts of the West Indies and Java where labour is cheap, but this rather tedious practice finds little favour in Queensland.

Field Sanitation: The elimination of weeds and grasses is a common agricultural practice which tends to reduce insect infestation, some pests being originally attracted by untidy overgrown fields. Such a measure directly reduces the breeding grounds of moth borers and many sap-sucking insects, such as aphids and leafhoppers, which are the natural transmitting agents of many virus diseases, and it indirectly prevents the rapid spread of these diseases. Mosaic disease of sugar-cane is a notable example of a disease whose spread is influenced in this way by the presence of grasses.

Variation of Planting Date: Early or late planting to avoid pest damage is a point frequently stressed. In the former case, the crop is past the susceptible stage, or matured, before the pest is capable of doing any appreciable harm; in the latter case, the pest is usually full grown and about to enter a quiescent stage of its cycle when the crop is planted, and similarly, serious damage is obviated. In North Queensland it is generally agreed that late-planted crops are less subject to bad grub attack than the taller early-planted crops. Around the Mackay district, wireworm damage is, to a point, less severe in late planted blocks than in those planted early. In South Queensland, autumn planting usually ensures a good strike and freedom from a number of pests, whilst spring planted cane frequently suffers damage.

Resistant Varieties: Deep rooting varieties of sugar-cane such as some of the P.O.J. canes and D. 1135 are much more resistant to grub attack than are shallow rooting varieties such as Q. 813. Again, canes with a hard rind are less subject to rat and borer damage as compared with canes of the softer and more succulent types.

Burning of Cane Trash: This system is largely practised throughout Queensland, where it aids considerably in reducing the numbers of beetle borer, which would otherwise migrate to surrounding fields and commence new centres of infestation. It should always be borne in mind, however, that such practices simultaneously destroy the Tachinid parasite, and where this fly is established burning of trash is not to be recommended as a form of borer control. The disposal of trash in this manner also tends to reduce the incidence of army worms, but again these may be successfully and economically controlled by the use of poison baits.

The Rotation of Crops: Crop rotation is a desirable form of control when dealing with insects which attack only one of the crops under rotation, but in Queensland, with the possible exception of a few of our minor cane pests, it is doubtful whether this measure would afford any relief from our more serious cane pests.

Mechanical Methods: The use of implements in the field has been developed to a greater extent in Queensland than in any other sugar-producing country, and it is not surprising that the idea of obtaining a high degree of insect control has been incorporated in the building of some of the machines which are used in the ordinary course of cultivation work. In this connection we refer to an improved rotary hoe with the rotor revolving at a high speed, pulverising the soil to a depth of 7-8 inches, and

chopping the ground every 2 inches as the machine moves forward. With this implement a kill of 92 per cent. of the grubs present in the top 8-inch soil level has been obtained, and it is thought that with a few minor alterations, such as increasing the number of blades and thereby securing a finer cut, its efficiency might be even further increased. It is capable of treating 3 acres per 8 hours at a cost of approximately £1 per acre, and it has already resulted in a considerable saving in cleaning up grub-infested areas.

CHEMICAL CONTROL.

Chemical control consists essentially of the direct application of chemicals to kill insects, and naturally their use is governed largely by the relation between the cost of the chemical and its application, and the amount of profit that can be expected from the crop in question. Chemicals may be used as insecticides in the form of stomach poisons, contact poisons, or fumigants. In the case of poisons, the type of insecticide to be used depends chiefly on the mouthparts of the insect to be controlled; i.e., whether they are of the biting and chewing type such as those of grasshoppers and caterpillars, or whether they are of the suctorial type such as those of leafhoppers and aphids. Pests having chewing mouthparts are controlled by spraying or otherwise finely coating their food plant with some poisonous compound such as Arsenate of Lead or Paris Green, so that when feeding on these plants they consume a quantity of the toxic compound which ultimately result in their death. In America, when grub-proofing lawns and golf greens, it is customary to mix quantities of lead arsenate with the soil when the greens are being made, or subsequently as top dressings, and any soil insects which happen to ingest this soil are soon killed by this poison, which remains effective for many years. Insecticides are sometimes mixed with a carrier such as bran or sawdust to which attractive substances such as molasses and lemon juice are added, and the whole mixture broadcasted in areas where the pest has assumed importance. The well known bran poison bait is an example of a successful bait used to overcome army worm infestation.

Such methods are of no use in the case of insects with suctorial mouthparts, since they ingest juices from within the plant. They are usually controlled by means of a contact spray such as nicotine sulphate or various emulsified oils, all of which adversely affect their breathing organs and soon bring about death.

Fumigants are another popular form of control. In most cases they possess anæsthetic and asphyxiating properties, which act very rapidly on the vitality of the insects, causing paralysis, and if the insects are forced to remain in this atmosphere they soon die. Fumigants to be used successfully must be used intelligently. For instance some, such as carbon bisulphide, are heavier than air and must be released above the insects which are to be controlled; others such as hydrocyanic acid are lighter and must be placed in such a position that the rising fumes will overpower the insects and cause their death.

Soil fumigation is one of the surest means of dealing with the greyback cane grub, in that the pest is attacked at the place where it will cause its greatest damage, and if fumigation be carried out whilst the grub is still in its early stages, the cane stool will suffer very little injury. In Queensland, it has been customary to use a mixture of carbon bisulphide and paradichlorbenzene as a fumigant for the control of the cane grub. This fumigant is injected into the soil by means of a Dank's or Vermorel Injector, a measured quantity being injected at each stroke of the plunger which is operated by pressure with the hand.

BIOLOGICAL CONTROL.

The forces of nature if left to themselves tend towards a state of balance, and no one plant or animal can continue to increase in over-whelming numbers for any great length of time. If an insect pest increases abnormally over a number of years, a host of forces attack it from all quarters, and soon reduce it to its former status. These forces consist in adverse weather conditions, diseases, parasitic and predaceous insects, birds and animals, etc. Man has no control over some of these forces, such as the weather conditions, but he is able to utilise some of the other agencies in the control of certain pests which have increased abnormally in different parts of the world. This form of control is usually referred to as "biological control" and is applicable chiefly to the control of foreign pests which have accidently gained entry into another country. Under such circumstances it is usual to search for the death factors which keep the insect in check in its original home, and having selected the parasite or parasites which are considered to be the most effective, these are bred artificially, freed of all hyperparasites, and introduced into the country where the pest is to be controlled. Biological control is an ideal form of control in that friendly organisms aid in the suppression of the pest without any concerted effort on the part of man other than that of providing suitable conditions for the develoment of the parasite. This form of control is most successful in insular areas such as Hawaii and Fiji, where the fauna is limited and where introduced insects are not subjected to attack from a vast array of hyperparasites, etc., with which they might have to contend in larger continental areas carrying a larger and more varied insect population. In Hawaii, the control of the sugar-cane leaf-hopper and the Anomola grub have been outstanding successes in biological control when other forms of control seemed futile and the sugar-cane industry of these islands was threatened with imminent extinction. These cases were amongst the earlier attempts to utilise biological control, and their brilliant success has done much to popularise this form of control. In more recent years the spectacular control of the Levuana Coconut Moth in Fiji, by a fly originally parasitic on the caterpillar stage of a closely related moth in the Federated Malay States, has been one of the greatest achievemnts in the biological control of an insect which threatened the existence of the coconut industry, and which defied almost all other means of control.

Within our own industry we have an excellent example of biological control in the suppression of the sugar-cane beetle borer by the Tachinid fly parasite. This borer pest, which is a native of New Guinea and the neighbouring islands, gained entry into Queensland in the early settlement days when the sugar industry was being established. At that time indiscriminate introductions of cane were made from other countries without adequate quarantine restrictions, and it was in this way that the pest became established. In their native New Guinea the sugar-cane and its parasite had been associated for centuries and had attained a state of adjustment in which there appeared to be no danger of the pest increasing to such numbers as to become a serious menace to its host. On the other hand it quickly became apparent that in some of the wetter districts of North Queensland the borer, unless controlled in some way, would soon prevent the growing of all canes of the desirable soft, sweet types.

In seeking for a means of controlling this pest it was therefore natural that a search should be made for the probable parasites which restricted its numbers in New Guinea. This search was largely directed by the late Frederick Muir of the Hawaiian Experiment Station and soon led to the introduction of the Tachinid fly into Australia. This parasite has since been

bred in large numbers by the Entomologists of the Bureau of Sugar Experiment Stations and has been liberated by them wherever the beetle borer has been found, and it now exercises a high degree of control over that pest where climatic and other conditions are favourable.

However, these brilliant economic successes do not present the whole picture of biological control of insect pests. In this phase of endeavour, perhaps more than any other, the path to successful achievement is strewn with the remains of optimistic attempts which have ended in abject failure. Biological control does not consist in rushing off to a foreign country, bringing back a number of parasites, and letting them loose upon the unsuspecting pest; to ensure the success of biological forms of control a whole complex of factors must be inter-dependently favourable. Such a project is not to be embarked upon light-heartedly, but only after the most mature consideration, since a false step may have most disastrous economic consequences through the upsetting of the whole biological balance. Therefore we will now review some of the conditions necessary for the effective operation of biological forms of control and, equally important, some of the reasons why it cannot be universally applied.

It will be evident that a parasite cannot entirely destroy its host (i.e., the species on which it completes its development) for with the gradual elimination of the host, and the increase of the parasite, a point is ultimately reached where the number of parasites is greater than the remaining hosts, with the result that many parasites fail to find a host for the development of their young, and these die without reproducing. Consequently a reduction in the number of parasites soon follows a reduction in host population, until there is reached a point of partial equilibrium whereat the pest does not increase greatly before a corresponding increase takes places in the number parasitised.

The limiting factors operating against the successful working of a parasite may be a question of climate, or the kind of crop infested by the pest, and upon this latter factor depends the parasite's ability to locate its host. In the large continental area of America over which the Japanese beetle has spread, we find that in certain districts a wasp parasite is the most efficient of the many introduced species, whilst in other parts a fly parasite contributes largely to its control. Reverting once more to the parasite of the beetle borer, we find that this fly is able to exercise its greatest degree of control in erect cane, whilst in cane that is lodging badly the fly is unable to penetrate the dense layer of trash in search of borer grubs, and therefore control becomes reduced. It is also interesting to note in this connection that Veitch found the parasite to work very efficiently in the rainy districts of Fiji, whilst in the drier zones of the same island colonies of this fly parasite, which resulted from similar sized liberations, almost invariably died out. In Queensland we find that this parasite is favoured by similar conditions, and it is well established in the moister districts such as Babinda and South Johnstone, whilst its establishment in the drier areas has been more difficult and less permanent. During the coming years, it is proposed to attempt to overcome these difficulties by liberating many thousands of these flies in borer-infested localities; data will be collected on subsequent control, and in this manner it is hoped to gain a clear idea of the degree of control that can be expected, and to evaluate the limitations of the parasite under varying conditions.

Biological control of army worms is also an important illustration to Queensland growers, especially in view of the fact that from a knowledge of the degree of parasitism being suffered by the pest they are advised whether it is considered justifiable to bait the pest, or whether to take no further

steps other than to allow the infestation to be cleaned up by parasites in the normal way. In certain seasons (for instance, 1932 in South Queensland) the pest has been very bad, and has threatened to ruin young ratoons wherever trash was conserved. In this particular year the droughty weather and the harsh winter had adversely affected the parasites, and the pest was able to breed up in large numbers practically unmolested. In late October the parasitism suffered amounted to only 10-15 per cent., and consequently bran poison baits had to be used to check their depredations. Hence the limitation of parasite control under a certain set of conditions will be apparent. However, during the past year in the same areas, larger fields of trash have been conserved, but a milder winter has been followed by a more rainy spring. Army worm damage has been very light—certainly insufficient to warrant extensive artificial control measures being instituted against them, and the parasites have been able to cope with the pest in an entirely satisfactory manner.

The most recent attempt of the Bureau to bring about biological control by means of introduced parasites has been directed against the Isis cane grub in South Queensland. For this purpose a Dexiid fly has been introduced from Canada on two occasions during the past two years. In Canada, this fly normally attacks a grub very closely allied to our cane pest. Small isolated fertile areas, such as the Isis district, surrounded by tracts of less fertile forest country, and which carry an insect fauna totally different from the surrounding one, have been likened to islands and are termed biological islands. It is thought that an introduced parasite, if once established, might become more efficient under such circumstances and less liable to suffer attack from insect parasites than if the same insect were introduced into a large continuous belt of similar country, carrying a varied insect population, and where it might be subject to attack from many quarters. Hence, one of our reasons for attempting to establish the Canadian Dexiid in the Isis district. Conditions for the liberation of this Dexiid were not however satisfactory, since drought conditions prevailed during 1931-32, and during 1932-33 host grubs were relatively scarce. It is yet premature to attempt to ascertain whether the parasite has become established or not, since very few of such initial liberations show definite results for some years, but this liberation will be watched closely and collections of grubs will be made periodically to ascertain if the parasite is actually breeding in this new locality. With regard to the time taken for a parasite to become effectively established, an extreme case is on record where a parasite introduced into America to control a certain fly pest was apparently ineffective, and was not recovered for twenty-one years after its liberation, but at the present time it is regarded as the most efficient natural controlling agent of this pest.

In the case of the "greyback" cane grub, the hope of attaining any appreciable increase in parasitism by the introduction of a foreign parasite does not appear very promising in the light of our present knowledge of the pest. This insect is indigenous to Queensland, and in its natural state the grubs fed on the roots of native grasses and other plants more especially in "scrub country." With the planting of these fertile jungle areas with sugar-cane, the greyback has been favoured with a set of conditions pre-eminently suitable for its wholesale multiplication, and it is now found in pest proportions from Mossman in the north to Carmila as its southern limit. Thus, the area covered by this pest, in contradistinction to being of the biological island type, is more truly of the continental type, and in this large expanse it is attacked by a considerable number of natural parasites, which in their turn are kept in check by hyperparasites, rendering them more or less ineffective. Hyperparasites are not, as a rule, specific, and they would in all probability turn their attentions to any new importations we might make,

and render them equally impotent. Further, since there are no overlapping generations, and the period of activity of any one of the stages in the life cycle of the greyback is relatively short, it is probable that an introduced parasite would require an alternate host to maintain it throughout the corresponding period of its cycle when grubs are not readily accessible. This necessity for an alternate host is considered to be a distinct disadvantage, since the parasite would then divide its activities between two or more species of grubs, rather than concentrate on the one pest whose numbers we wish to materially reduce. However, this side of the question will be further investigated with a view to discovering any circumstances which might justify our proceeding with such a desirable form of control.

Hitherto we have dealt with biological control from the point of view of control by insect parasites, but it is well to remember that diseases often take heavy toll of dense insect populations. These diseases are, however, rather unreliable, and are usually dependent for their wholesale development upon a set of favourable weather conditions. Birds, too, are generally regarded as being of great assistance to man in keeping down his insect enemies, and one has only to watch a flock of ibises following behind ploughs and ridding the land of soil-frequenting insects to be convinced of the numbers they are able to destroy. Crows also are assiduous grub eaters, but in some seasons when food is plentiful they are somewhat diffident in following the ploughs. Other smaller birds often show a decided preference for the smaller parasites and predaceous insects, and their importance as grub destroyers appears to have been overrated in certain instances. In the West Indies, the giant toad, *Bufo marinus*, is believed to exercise a very appreciable degree of control upon the beetle stage of "white grubs." This animal has recently been introduced into Hawaii and we are watching its activities closely with a view to its introduction into Queensland.

LEGISLATIVE CONTROL.

Legislative control is preventive rather than remedial, and the institution of a strict quarantine aims at preventing the importation of foreign pests. Although most of our serious sugar-cane pests are native ones which have turned their attentions to cane, a notable exception is the sugar-cane beetle borer, which originally came from New Guinea, and we might well ask ourselves how much better off some individuals might be if they were not embarrassed by the presence of this pest on their farms. Other important pests are to be found in nearby sugar-producing countries, but these we fortunately have not yet acquired. However they remain potential sources of danger if attempts are made to evade the State quarantine regulations, or if the indiscriminate introduction of new varieties were permitted. With the quicker modern methods of transport, and the extended use of aerial travel, the chances of foreign pests being imported into Australia appear to be considerable, despite the existence of rigorous quarantine restrictions, and if some of these pests became established our sugar industry might suffer serious losses before they could be brought under effective control. Again, some of our resident pests have not yet succeeded in becoming established throughout the whole of the sugar districts of Queensland. Whether this was due to previous unsuitable conditions, or to the happy circumstance that none of these pests were ever introduced into clean areas with the exchange of planting material, is more or less a matter of speculation at the present time. However, with the extension of irrigation in some of the drier belts, and the consequent production of larger crops, uncontrolled interchange of plants might easily result in the spread of some of these pests to areas far beyond their present limits, now that conditions in these latter districts appear to be more suitable for their establishment. To guard against any

such occurrence, inter-district quarantines have been established, involving eight major districts, and a proclamation has been issued prohibiting the removal of cane for planting purposes from one major district to another, unless under permit from the Bureau of Sugar Experiment Stations. In order further to discourage the transport of varieties from one district to another there has recently been enacted an amendment to the Cane Prices Act whereby there is required to be published each year a list of the varieties which are approved for each mill district, all other varieties being automatically disapproved and subject to penalties. This amendment is intended to remove the incentive for variety fanciers to collect canes from all over the State, a practice which has already had the most serious consequences in spreading diseases to new localities.

Such laws are of little avail unless they are backed up by a well informed and well disposed public opinion. The spread of insect pests constitutes a real danger, and all growers and others interested in the welfare of the sugar industry should accord their sympathetic co-operation in the enforcement of any measure aimed at pest restriction.

PULLING OUT FENCING POSTS.

This illustrates a method of pulling out fence posts. This fulcrum, having two legs, stands firmly on the ground, with the top against the post which is to be pulled out. The horse can pull a dozen times without the position of the fulcrum being affected. Having a lean against the post, it makes the task of lifting the post easy in every way, and lighter on the horse. The fulcrum should be about 4 feet long,

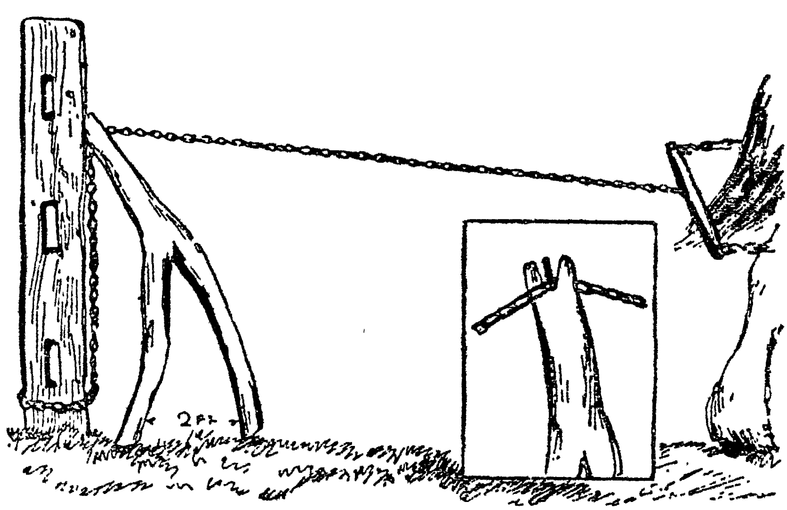


PLATE 85.

and it is all the more effective if it has a bend. The two bottom ends should be about 2 feet apart, and placed, say, 2 feet 6 inches from the post. It is advisable to cut them so that they will hook into the ground, and not slip. A V should be cut in the top of the fulcrum and a pin inserted without a head, so that it will fit into any link of the chain, which should be made as tight as possible between the top of the fulcrum and the bottom of the post. Aided by this contrivance a man, with a good horse, can easily pull out a mile of fencing a day.

By J. J. McLACHLAN, F.B.S.A., Poultry Inspector.

IN Queensland, ducks are chiefly kept for table purposes, although quite a number of small flocks are kept for egg production. There are very few specialised duck farms; the usual practice is to keep a flock of ducks as a farm sideline. The market for table birds is usually kept fairly well supplied from existing sources, high values are therefore not regular. Reasonably high prices are, however, obtainable when the demand is firming for the Christmas trade. This fact indicates the necessity for a continuous supply of cheap foodstuffs suitable for growing ducks destined for the table. The keeping of ducks for egg production is not practised extensively in this State; this is possibly due to the unpopularity of the duck egg, making it somewhat difficult to market. It is all a question of taste, for a duck egg is equal to a hen egg in food value, and, provided the birds are fed on good wholesome food and kept under strict sanitary conditions, it would be fairly difficult to distinguish any difference in general quality. Ducks are more prolific layers, have a longer profitable life, are more easily reared, and are freer from disease than other poultry.

The foremost breed is the Muscovy; this bird is essentially a table bird, and may be found all over the State. The Muscovy is distinct from all other breeds of ducks and will always remain distinct, for if this breed is crossed with any other breed of ducks the progeny will be mule ducks.

THE MUSCOVY.

General Characteristics.

The head is large, and at times it raises the feathers in fan shape; the beak is thick, with a band of reddish colour, the nostrils and the face being covered by carunculated flesh; the eye is brown; the neck is thick and of a fair length. The body is a great frame, rectangular in shape and nearly horizontal, short and powerful in leg, with fairly large feet, webbed to end of toe, with powerful claws. The male has no curled feathers in the tail, as other breeds; his plumage is of a brilliant bronzy black, with a green sheen. Legs of both sexes are black to the toes.

The female is similar to the male, but only half the size, without the wrinkled flesh around face, and duller in plumage than the male.

PLATE 86.—A TYPICAL MUSCOVY DUCK.

Size.

The average weight of the drake is just over 12 lb., but many reach 14 lb. and over. The duck, however, is less than half the weight of the drake, and it is a very large duck which attains 6½ lb., the average being about 5 lb. The adult drake is enormous—measuring frequently 32 to 34 in. in length; it walks slowly and heavily.

INDIAN RUNNER.

General Characteristics.

Of the egg-producing ducks, the Indian Runner predominates in numbers. But the Khaki-Campbell is becoming very popular and is equal as a layer, whilst it is slightly heavier in body weight than Runners.

Head.—Fine and somewhat flattened over the skull, with the eyes full, bright and clear, showing alertness, and situated high up in the skull. Bill strong and deep at the base where it joins and fits almost insensibly into the skull, and thence comes as nearly as possible straight down to the tip, giving it a wedge-shaped appearance, of good average length.

(*Note.*—The shape is more important than actual length or width, and it should be proportionate to the build and size of the bird and well set into the head at the junction. Very flat or dished bills with rounded under-line are objectionable, and abnormally long heavy bills are liable to be accompanied with coarse heads and thick necks, which are serious faults.)

Neck.—Neck very fine, thin and slender to where it begins to form the expansion towards the base of the neck, which expansion should fit almost insensibly into the upper part of the body, so as to appear almost part of it, the head and neck carried high and slightly forward, and not curved or carried swan-like.

Body.—Body—the lower portion of the neck expansion is included—long and narrow, of nearly uniform thickness, very tightly feathered.

Wings closely packed; approximately about twice the length of the neck to the top of the head. When standing erect, the stern appears comparatively short and curves round to the tail, which is close and neat, and in the best specimens carried nearly in a line with the body, but in some excellent birds it is slightly elevated or turned upwards, and a fullness of the lower stern is frequent in the most prolific layers.

Legs.—Legs placed much farther back than in other breeds of domestic ducks. Shanks comparatively short, with small supple feet and strong thighs to enable the bird to balance properly and maintain an upright position when on the run.

PLATE 87.—WHITE INDIAN RUNNER DUCK.
Note upright carriage which is characteristic of this breed.

Length and Size.—As layers of a great number of large eggs, substance and constitution are necessary in the breed; small, square specimens are useless, while heavy bulky birds are less active as foragers

and open to the same objections. A medium size with good reach and perfect symmetry is advisable, but appearance and activity should be a truer guide than actual weight and measurements.

Carriage.—In comparison with other ducks, the body is more tightly feathered and appears longer and thinner, and this impression is heightened by the remarkable erect carriage and the fact that the bird when on the alert carries its neck and body almost in a line at an angle of from 50 to 70 degrees to the horizon. Its gait is peculiar in that it travels with a straight-out run and does not waddle or roll like the ordinary duck. In general appearance and shape when in motion, it has, not inaptly, been likened to a soda-water bottle set at an angle of 50 to 60 deg., a character which is best seen in a front or semi-front view. When startled, standing at attention, or trained in the show pen, it assumes an almost perpendicular pose or attitude.

Weight.—Drakes, 3½ lb. to 5 lb.; length 26 inches to 32 inches. Ducks; 3 lb. to 4½ lb.; length 24 inches to 28 inches. The above are fair standard weights and lengths, but must count for nothing if not accompanied with type and well-balanced proportions.

There are three varieties—Fawn, Fawn and White, and the White.

THE KHAKI CAMPBELL DUCK.

General Characteristics.

This is a moderately small breed, the body being wide and fairly deep, with slightly upright carriage and finely-shaped head and neck. In the male the bill is green (the darker the better), the head, neck, stern, and wing-bar bronze, and the rest of the body an even shade of

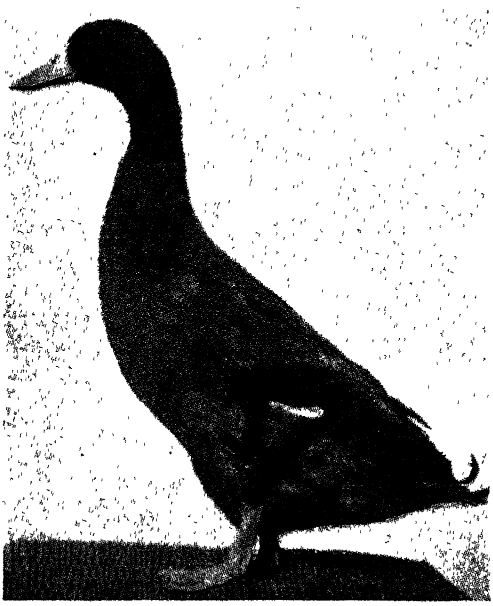


PLATE 88.—A KHAKI-CAMPBELL DRAKE.
A Prolific Laying Breed.

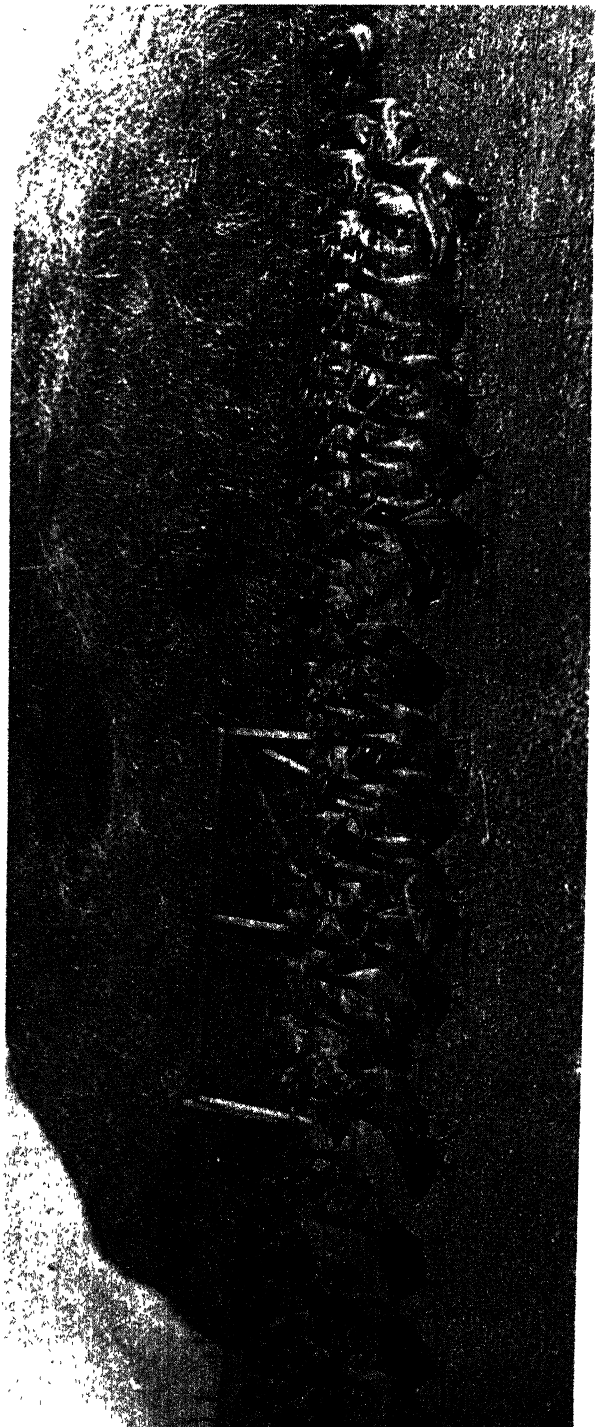


PLATE 89.
A flock of Khaki-Campbell Ducks on a Victorian farm.

khaki or dark buff, with dark orange legs and feet. In the female the bill is greenish-black, the plumage being khaki or dark buff all over, with even ground colours while the back and wings are laced with a lighter shade of buff, and the legs are dull orange, both bill and legs being several shades darker than in the drake. Lightish feathers in the wings are allowed, but white bibs are untypical, as are yellow bills. Khaki Campbells are tame and tractable creatures, and prolific layers of white eggs.

Weight—both sexes, 4½ lb.

HOUSING.

The mild climatic conditions in Queensland obviates the necessity for the construction of elaborate or costly houses for the accommodation of ducks. That does not mean that ducks can be herded profitably into any class of a house. Houses should be built similar in design to ordinary poultry-houses, a lean-to building facing north or north-east, open-fronted, with a ventilation space at the top of the back wall. Buildings so constructed will afford the ducks most protection against prevailing winds and rains whilst at the same time the sun's rays penetrate into the house.

Construction.—The building need not be deeper than 5 feet, and the roof could be 6 feet high at the front and 5 feet high at the back, and a ventilation space of 3 inches at the top of the back wall would be satisfactory. In estimating the size of the building, allow 2 square feet of floor space for each duck; thus, a building 10 feet long and 5 feet deep will accommodate twenty-five ducks. The best materials for the construction of duck houses is sawn hardwood and galvanised corrugated iron. Some persons may desire to make use of bush saplings so as to have cheaply constructed buildings; this may be done, but it is essential to have an iron roof. It may be thought that as ducks usually camp out in the open it is unnecessary to have an iron roof, but this is absolutely essential, for one of the most important factors in the housing of ducks is a dry floor.

Floors.—It is essential for the floor of the house to be dry at all times; a damp or wet floor in a duck house may cause many deaths among the flock, while practically the whole flock will receive a check in growth or production. To ensure dry floors, build up the floor at least 4 inches above the level of the surrounding land; also excavate drains on the highest side of the house, so as to carry away storm water. Concrete floors are best, but an earth floor that has been tamped down fairly hard will be satisfactory. To facilitate cleaning, cover the floor with coarse sand or a litter of hay, grass, or straw. The litter will act as a bedding for the ducks. Nests should be provided. These may be placed on the floor against the walls.

BREEDING.

It will be found most profitable to adopt the same breeding season for light-breed ducks as generally adopted for other poultry—namely, June to September. Ducks hatched during these months will commence laying when egg values are high, and continue for about twelve months before moulting. Heavy breeds hatched during June, July, and mid-August, will be more profitable, as they can be marketed in prime condition for the Christmas trade. The breeding of heavy breeds may be

continued throughout the year, providing that a constant supply of cheap suitable foodstuffs is available.

Selection and Mating.—Care must be exercised in the selection of breeding stock. Special attention must be given to type and size. A careful study of the description of the breed is necessary, so as to be able to select birds that are reasonably true to type. Ducks have a tendency to deteriorate very rapidly in size; therefore, it is essential to maintain size of body when selecting breeding birds. In this regard, it is good policy to weigh the birds before placing them in the breeding pen. Defective ducks should not be used for breeding purposes. In mating, the number of females to mate with each male varies with the age of the male, size of run, whether the birds have access to a swimming pool, and the breed. On an average, mate between six and eight females with each light-breed male, and from four to six females with each heavy-breed male. The number of females may be increased if the male is young and very vigorous. Ducks may be safely bred from until they are three or four years old.

PLATE 90.
The proper way of holding a duck.

MANAGEMENT.

Ducks should be kept apart from fowls, as they are greedy feeders and often prevent the fowls from obtaining sufficient food. Their way of feeding is also slightly different. Apart from these factors, ducks make the drinking water unsuitable for poultry. A swimming pool is not a necessity, but where ducks have access to a pool, they keep in better health, their plumage is cleaner, and they are more free from external parasites. In addition, a higher degree of fertility results if breeding birds have access to a swimming pool. As the duck usually lays in the night or early morning, it is necessary to confine them to the run or house until about 9 a.m., otherwise many eggs may be laid in the pool.

Ducks must have a constant supply of clean, cool, fresh water, and when confined during the night water must be supplied. The water

PLATE 91.
A flock of Muscovy Ducks on a creek at Enoggera, Brisbane.

sels should be deep enough for the duck to submerge its head in the ater.

Ducks are naturally clean in their habits, but if confined in a small enclosure not properly drained, filthy conditions will result. Therefore, strict sanitation should be practised.

When kept in large numbers, ducks, particularly Indian Runners, are very excitable and easily frightened, and if frightened they are very liable to go into a partial moult.

INCUBATION.

It is the usual practice not to set the first batch of eggs laid by a duck, these being often infertile; also, if fertile, weak ducklings usually result from such eggs.

The period of incubation is 28 days for all breeds with the exception of Muscovy eggs. These take 35 days to hatch. The incubation of duck eggs is best done with ducks. If broody hens are used, it will be necessary to sprinkle the eggs with water regularly. Also sprinkle water on the ground close to the nest, for when the hen comes off she will dust-bath, and her feathers will be moistened when she returns to the nest. The duck, however, will moisten her feathers sufficiently before returning to the nest. With artificial incubation, the temperatures should be about 1 degree lower than that for hen eggs—namely, 102 degrees. After setting, the eggs should not be disturbed for 48 hours. After this period they should be turned twice daily, and cooled daily. Each time the eggs are turned, before being returned to the machine they should be sprinkled with warm water. This sprinkling is essential, because the eggs require a lot of moisture. Test, and remove all infertile eggs. Do not open the machine after the ducklings commence chipping until the hatch is complete. Ducklings take longer to break out of the shell than chickens.

REARING.

Ducklings are very hardy, and easy to rear, therefore rearing may be done by artificial methods. Any type of a simple brooder that will permit of water being kept within access of the ducks will prove satisfactory. For instance, a frame with four legs about 6 inches high to which is tacked a piece of hessian from which flannels hang to within an inch of the ground will give results. First place ample straw on the floor, put down the brooder; the ducklings should be kept under the brooder the first day without food or water. To confine them, use inch netting close up all around the brooder. By adopting this practice they will know where to go when feeling cold. The following night they may be allowed 8 or 10 inches around the brooder, and in this space place water vessels. After about a week, it will not be necessary to confine them to the brooder. After about three weeks the brooder may be removed, providing that ample straw is placed in the shed. One important point must not be overlooked, and that is ground draughts must be prevented. Every day the straw should be forked up and, if necessary, replaced with clean, dry straw. Ducklings must not be crowded; best results will be obtained by rearing ducklings in small units. When about four weeks old they may be placed out in houses, for they do not then require much attention apart from plenty of food and water. Ducklings should be protected from the hot sun until

they are well feathered on the head and neck; this is more impo with Indian Runners than other breeds. Therefore, the rearing should have a number of shade trees growing in them; if not, artific shade must be provided.

FEEDING.

Ducklings require no food for 48 hours after hatching. During this period they could be supplied with water, coarse sand, and charcoal or wood ashes. A mash that will give good results if fed from the first meal until they are about four weeks old is prepared by mixing together pollard, 10 lb.; maizemeal, 8 lb.; dried buttermilk, 2 lb.; bonemeal, ½ lb.; and fine salt, 2oz. If these ingredients are mixed together the amount for each meal may be moistened as required. If available, 3 lb. of curds would replace the dried buttermilk, thus cheapening the ration. Skim milk is excellent for ducklings; it can be used to moisten the mash, but do not give it in the form of a drink. If there is ample milk available, allow it to curd and strain off the whey, then feed the curds. Imitate nature as far as possible by giving several small meals daily to young ducklings. A little and often is a good motto to adopt. After four weeks of age, they may be fed on a similar ration to the mature ducks. When mature it is only necessary to give them three meals daily, supplying as much food as the ducklings can consume in about half an hour. Be sure they have a big evening meal.

Plate 92.
Ducks should be caught by the neck.

A ration that will give excellent results for the feeding of mature ducks is comprised of the following ingredients:—Pollard, 55 lb.; bran, 25 lb.; maizemeal, 10 lb.; meatmeal, 10 lb.; bonemeal, 1 lb.; and fine salt, 1 lb.; to which may be added 25 per cent. of cooked vegetables or chaffed greenstuff. The salt should be mixed in the liquid first, so as to ensure a thorough incorporation in the mixture. At least two meals should be given daily, but with mature birds a small meal of whole maize may be fed in addition to the mash.

For the fattening of ducks, consideration must be given to the availability of cheap foodstuffs, which are often obtainable in the form of potatoes, pumpkins, and other vegetables; these should be boiled and

vessels be added to the mash upwards to 40 per cent. of the bulk. Chaffed greenstuff should be included, but do not use much greenstuff when making use of a large proportion of other cheap foodstuffs, otherwise the mash may be too bulky.

Always keep a supply of shell grit and coarse sand in receptacles before the birds.

WATER.

Water is one of the biggest factors in successful duck-keeping; they must always have access to ample clean, cool, fresh drinking water. The water vessels or pool should be sufficiently deep to permit the ducks to submerge their heads. The water vessel should be kept under a shade tree or protected from the sun by providing artificial shade. In rearing ducklings, it is a good plan to put a number of stones in the water vessels: this prevents the ducklings swimming and wasting the water.

Water vessels should be constructed so the ducklings can get out easily in the event of their swimming in the vessels, otherwise they may drown through cramp. This cramping is more likely to occur during cold weather.

COMMON TROUBLES.

As stated previously, ducklings are hardy and easily reared, but losses will occur if they are neglected. The most common troubles are chills and staggers.

Chills.—Symptoms—Watery eyes and nostrils. Cause—Wet or damp sleeping quarters.

Remedy—Keeping the floors dry is the most important point. The drinking water may be slightly coloured with permanganate of potash, and changed several times daily.

Staggers.—Symptoms—Ducklings stagger about and fall on their backs before dying. Cause—Lack of water. When water is supplied after there has been a shortage, the ducklings gorge themselves, bringing about this condition.

Remedy—Keep a constant supply of drinking water before the ducklings.

WHEN SENDING SPECIMENS—NOTICE TO READERS.

With every mail numbers of letters are received from readers requiring advice on matters affecting their crops, stock, &c. Many of these letters are accompanied by specimens about which information is desired. Much trouble would be saved if the sender of each package clearly marked his name and address on the outside. Often the only means of identifying specimens is by a comparison of the handwriting on the address with that on the letters received. Letters should not be enclosed in packages, nor should packages be sealed in such a way as to prevent examination by the postal authorities, for in such cases postage is charged at the letter rate of 2d. per ounce, and the Department of Agriculture and Stock has to pay double the deficiency.

Flocks and Fleeces.

By J. CAREW, Senior Instructor in Sheep and Wool.*

WITH the sheep and wool industry is wrapped up the progress and prosperity of Queensland. Vast tracts of our Central and Western territories are so well adapted naturally for depasturing sheep that the highest quality of merino wool is produced on country where the range of regional rainfall is only from 12 to 20 inches annually, and with no other land improvements than water provision and fencing. In this country, and under the conditions prevailing, the Merino finds its home, and it is the wonderful adaptability of the breed to its territorial environment that has made it the most important factor in the economy of the State.

Where sheep are to be run on grass alone, under the conditions that prevail in our far inland areas, this breed has no superior and we cannot do better than foster its improvement and increase its numbers.

Queensland merino wool has earned a great reputation for the general quality and fineness of its fibre; and, as it fulfils all the requirements of a constant and strengthening market demand, every endeavour should be made to eliminate any coarseness of type not characteristic of the pure Merino. Other countries can produce breeds other than the Merino and that carry coarse wools. It would be to our advantage to avoid competition in wool production in these types, especially in our Central and Western areas. Where sheep are associated with agriculture, the Merino can also be utilised, but in a different way and to a more limited extent. In every country where sheep have been introduced it has been found that some breeds thrive and do better than others. In caring for the breeds that had done best, they were found to develop under the change of environment special characteristics either in type, conformation, constitution, or covering.

British Breeds and Crosses.

The most interesting instances of improvement in breeds and types may be observed in the British Isles where about thirty breeds have been evolved. Each breed is distinct in formation, size, and character; as well as in the length and colour and quality of its wool. Very few distinct breeds were first introduced into Britain, but by crossing to suit special environmental conditions and sticking to the type evolved they developed a set breed. By careful selection, these breeds have been maintained true to type for years. They are chiefly associated with agriculture and adapt themselves more successfully to cultivated crops than the Merino. Many of the British breeds have been introduced into Australia, and those which have done best have also been brought into Queensland chiefly for crossing with the Merino. In this respect they have been very successful, but we shall have to continue introducing them unless studs are started here.

As the Central and West is suitable for breeding the Merino, so is the Darling Downs and similar areas suitable for breeding both the English long-wools and Downs breeds. The chief points leading to success if the sheep are kept under congenial conditions are that they are kept in good health and properly fed. This is a matter requiring forethought and judgment. Where the annual average rainfall is between

* In a broadcast from Radio Station 4QG.

20 and 30 inches, it should be possible to grow a fair quantity of fodder crops for fattening purposes and for conservation. Under these conditions these English breeds can be reared successfully and studs established. Only sufficient stud flocks would be kept to replace the wastage in the sires required. All the drop not selected for this purpose could be disposed of as lambs for home consumption or export. There would be no necessity or advantage in taking any of the strains of the British breeds back into the merino country. In present circumstances, the expansion in production of many crops that can be grown successfully on the Downs, and closer in to the coast, cannot be done profitably unless a greater number of stock are raised and sold on the hoof.

I consider that the greatest oppórtunity for agricultural expansion is offered in the breeding and fattening of lambs for export. For this purpose, the whole of the progeny of all Downs crosses could be sold at about four and a-half months. The Downs breeds will cross well with the Merino, but in this respect the best results could be expected by using the stronger type of plain-bodied ewes. Where the English long-woolled rams are used, all the ewe progeny could be retained for breeding purposes. The Lincoln, Border Leicester, and Romney Marsh have already proved themselves satisfactory for this purpose in Queensland. The less Merino and more Romney Marsh near the coast will be the strain to suit the conditions. Further inland, and for higher and better-drained conditions, the Lincoln and Border Leicester, especially the latter, is to be preferred.

The progeny of the long wools are not as quick to mature and fatten as the Downs crosses, the Border Leicester excepted.

The Farmer's Breeding Flock.

The ideal type of farmer's breeding flock is a quarter-bred long-wool three-quarter-bred Merino. This type is strong and robust, well adapted to stand adversity, and make a good recovery; and they can be mated both in autumn and spring. Their wool is usually of a good, desirable type, an important point in a flock that has to be maintained from year to year. If the breeding flock is retained for about five years, they should then fatten successfully. It is far more profitable to fatten the breeders off before they become too old, for it is among aged sheep that heavy losses occur.

All countries have their seasonal difficulties, and Queensland is no exception. There are periods when little or no provision, other than that provided by nature, is necessary; and this is, to some extent, responsible for the lack of provision by most of our sheep farmers.

Successful fat-lamb production must follow the plough. Fortunately for us, we can produce successfully in normal seasons both summer and winter crops in all districts suitable for the English breeds of sheep and their crosses. Health is another matter of great importance, but fortunately we have no parasite or disease here but what can be successfully dealt with. The ordinary stomach worm is the one parasite in our agricultural areas that causes the greatest amount of trouble, and these are extending well out to the West.

Drenching and Dipping.

Too much care cannot be exercised when introducing sheep on to a holding, and if there is any suspicion of worms they should be drenched twice at intervals of eight days.

In recent years lung worms have been causing considerable trouble, especially in the southern part of the Darling Downs. The introduction of stud sheep from lung worm areas in the South is, to a great extent, responsible for this spread, for very few store sheep cross the border. Chiefly because of the probable introduction of parasites and diseases with imported stock, I advocate the establishment of a small stud by the farmers themselves. The blowfly is a pest that causes enormous losses to the pastoral industry every year, and the sheep that carry other parasites are more prone to fly attack than healthy sheep. Sheep lice and ticks are parasites that also cause considerable irritation to the sheep, and consequent loss of flesh and wool. By drenching with suitable drenches for the ordinary stomach worms a big protection is given to the sheep against lung, tape, and nodule worms, besides improving the health of the flock, which enables them to resist the attack to a far greater extent.

By dipping all sheep in a good, reliable dip about six weeks after shearing, both lice and ticks are practically controlled for the year. A second dipping will be necessary if a liquid dip is used. Where arsenic is incorporated in the dipping mixture, a considerable benefit will be derived as a protection against the blowfly. If flies are prevalent at the time of dipping, large numbers will be destroyed. If rain occurs within a few weeks after dipping, the flies generally get busy on the damp wool, with the result that more of them will be destroyed. In fact, dipping pays the sheep farmer well where the need exists for protecting his flock against pests and diseases.

Scouring the Clip.

There are many systems of treating wool in the scouring process. Different makes of machines are procurable, but their use is out of the question when only small lots are to be treated.

The potsticks have been superseded by the wool-washing boxes. The latter requires a plentiful supply of water, which should enter in such a way as to keep the wool open and slowly revolving without becoming ropey. These boxes are made of wood, and big enough—about 3 feet square—to allow a man to reach all parts comfortably. Inside this box is a close wire or perforated zinc tray made to prevent the loss of small locks during the scouring process. A space of from 2 to 3 inches is allowed between these two boxes for the free passage of water. The outer wooden box is fitted with a valve for quick drainage. The water is supplied from an overhead tank and enters the box at the bottom, which keeps the wool open while the box is in use. For convenient working there should be two soak tanks and two washing boxes to be used alternatively. The two washing boxes are then filled with wool from the first soak tank. Between the two washing boxes should be a draining board sufficiently large to take the wool from one washing box. The wool is allowed to drain while the second box is washed and the first box refilled. This drained wool should be put into a centrifugal or hydro-extractor, for the sooner the wool is freed from water the better the colour. This outfit requires capital and a plentiful supply of water; so where small lots are to be treated tubs may be used both for soaking and washing.

The ordinary common bar soap will be found suitable to put in the soak tank, 1 lb. to 300 lb. of wool, which can be soaked in 200 gallons of water, or in like proportion. Caustic soda should not be used in scouring

wool, but matured caustic soda soap is quite safe. This can be made according to directions on the containers, but the larger the quantity the longer it will require to be stirred. The fat should be stirred well to ensure that it is all melted, and then allowed to cool down to lukewarm, or to when it commences to harden on the sides, before adding the caustic lye. After cutting into bars it requires at least six weeks to mature. To prepare it for use, dissolve 1 lb. of soap in 2 gallons of water by boiling, and use as required to make the liquor the desired strength. The water in the soak tank should be from 100 deg. Fahr. to 120 deg. The wool should remain in soak for at least half an hour. Vary the quantity of soap and the temperature of the soak liquor according to the nature of the wool. Dusty wools require more soap, less heat, and longer soaking than ordinary heavy-conditioned wools, such as locks and stained pieces.

Without the centrifugal, wool should be allowed about ten minutes to drain, then pressed to squeeze out all surplus water and immediately spread on hessian sheets 8 feet by 6 feet and left in the sun to dry. Treatment during drying is important, as all lumpy wool will dry a dull colour. To avoid this, hold the wool to the body with one hand and tease out in small handfuls with the other while turning it. While on these sheets the wool should be turned and teased out twice a day. When thoroughly dried, roll it up in the sheet on which it is spread and stack for a few days in a heap under cover. This allows the wool to become uniform in condition throughout.

Before scouring, the wool should be sorted into classes as even as desired to secure a product even in quality, length, colour, and condition Belly wool, stains, and locks should be kept separate.

QUEENSLAND SHOW DATES, 1934.

August.

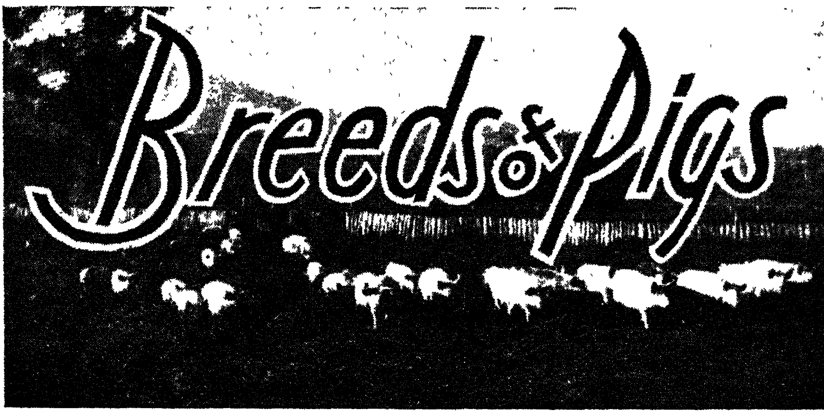
Royal National, 6th to 11th
Home Hill, 31st August and 1st September

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Pomona, 12th and 13th
Innisfail, 14th and 15th
Mareeba, 20th and 21st
Beenleigh, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Southport, 5th
Millaa Millaa, 5th and 6th
Tully, 12th and 13th



PART I.

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

The Large White.

ORIGINATING in Yorkshire, England, and formerly known as the Large Yorkshire, the Large White, one of the best known of British breeds of pigs, has, in recent years, gained world-wide fame and popularity, and is now the most widely distributed of all pure breeds. Its history is full of interest, for it was one of the first of the breeds claiming origin in the United Kingdom to be developed and popularised, although in those early days it was not of the same excellent type and conformation as at present, nor did it carry the same breed designation.

Breeders not only persisted in their efforts to improve and commercialise the new breed, but at considerable expense to themselves exhibited at live-stock fairs and village stock shows. In this and many other ways they brought under the notice of farmers of the Homeland their importance as an influence in the breeding of a better type of animal. Progress in such work was necessarily slow and difficult.

For many years, particularly in Australia, this breed appeared to lose favour. The Large White has now regained its popularity, and has proved its adaptability and suitability to such an extent that it now holds pride of place in the pig world; and is represented in official herd books by a greater number of registrations than any other known breed, British or American.

Breed Characteristics.

The Large White is one of the largest of the British breeds of pigs, its long and abundant coat of white hair on a white or pinkish-coloured skin being characteristic, the pinkish-coloured skin indicating breeding and quality, while freedom from blue or dark spots on the skin is an important point. It would not be correct to say that the presence of one or two of these blemishes on the skin is an indication of lack of quality or purity in the breeding, for wherever white-skinned pigs are bred there is a tendency for blue or dark-coloured spots to appear, more particularly above the eyes or in the vicinity of the ears, with an occasional spot on the back or rump.

It is to the credit of the Large White that it has frequently been successful in winning bacon pig and bacon carcass contests throughout the world; that it is invaluable for crossing and is recognised especially for this characteristic. It is a recognised sire for imparting quality to stock which lack this very necessary qualification; it is excellent for bacon production, more particularly where crossed with blocky or thickset stock; it matures quickly and to advantage, and is recommended by curers and butchers, especially by those who are more conversant with the virtues of this type and its crosses with other breeds. It is universally recognised for all these qualifications and, while able to satisfy the varied requirements of the general agriculturalist in this and other countries, it is especially adapted for use in commercial pig farming under the open-air system, so desirable wherever pigs are kept in numbers sufficient to justify the outlay necessary in providing additional outdoor accommodation.

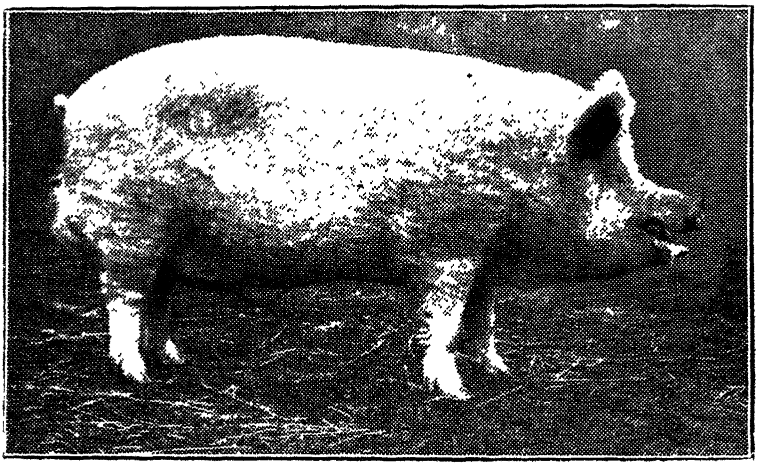


PLATE 93.

Large White Boar of approved type as recommended for use in the breeding of bacon pigs suited for local and export trade. Note sturdy appearance of this well-known sire.

The breed is exceptionally prepotent, in fact, both this and the Middle White have this desirable characteristic to a marked degree, and wherever the white breeds are used the bulk, if not all, of the progeny will be white in colour, and very true to type. Prepotency has been defined as the power one parent has over another in transmitting its qualities and breed characteristics to the offspring; thus the Large White as a sire transmits his qualities, type, and colour to a very marked degree when crossed with a blocky thick-set sow of, say, the Berkshire type. In its turn, the Berkshire, also a prepotent breed, gives a compactness and desirable conformation to the progeny, but fails to transmit its colour, because in that respect the white breeds carry a greater degree of prepotency. The reverse holds good also, for when the Berkshire boar is crossed with the Large or Middle White sow the majority of the progeny will be white in colour, though perhaps showing more of the Berkshire type than where the white pig is used as a sire.

Another desirable characteristic of the Large White is that of fecundity or prolificacy. It is not only an advantage to the farmer that his stock should breed freely and regularly, but that they should also reproduce themselves abundantly.

Fecundity as a breed characteristic and, particularly in the Large White, runs in families; hence within the breed there are many families more prolific and more desirable than others, although the latter may be true to type, colour, and general conformation. It is noticeable, too, that although the degree of fecundity in live stock is, to a very large extent, influenced by the feeding and conditions under which the animals are kept, this breed appears to maintain its prolificacy under almost every condition, although, as will be understood, there is a very much higher infant mortality where the stock are neglected than where they are given proper housing accommodation and attention.

It has been noted by those who have devoted time to careful research to these problems that the breeding powers of animals are most energetic when the animals are in moderate condition, uninfluenced either by extreme fatness or the reverse; hence, as the Large White breed is one that maintains itself in moderate condition and does not tend to run to fat, it is more fecund or prolific than those breeds inclined to fatness and of more blocky stature.

In the Farrowing Returns for 1932 published in the Herd Books of the National Pig Breeders' Association of Great Britain, it will be noted the feature of prolificacy is most pronounced, while the capacity to suckle and rear their families compares more than favourably with other breeds.

N.P.B.A. Farrowing Returns, 1932.

SUMMARY.

Breed.	Number of Litters Notified.	Average Pigs Born per Litter.	Average Pigs Reared per Litter.
Berkshire	382	8·46	6·87
Large White	5,713	10·32	7·86
Middle White	1,638	9·55	7·57
Tamworth	129	8·28	6·19
Wessex Saddleback	727	9·62	8·12

This shows that, of 5,713 litters notified, the average pigs born per litter, 10·32, was the highest of the five breeds of whom particulars are recorded by the N.P.B.A., and that the infant mortality was little or no higher in this than in any of the other breeds, the exception being the Wessex Saddleback, who, over several years, have recorded the highest percentage reared of pigs farrowed.

The breeder wants boars and sows that are prolific and ready breeders, whose litters are not only large, but in which each pig is a strong and quick grower. They must be of a firmly established type so that a litter shows uniformity in all points.

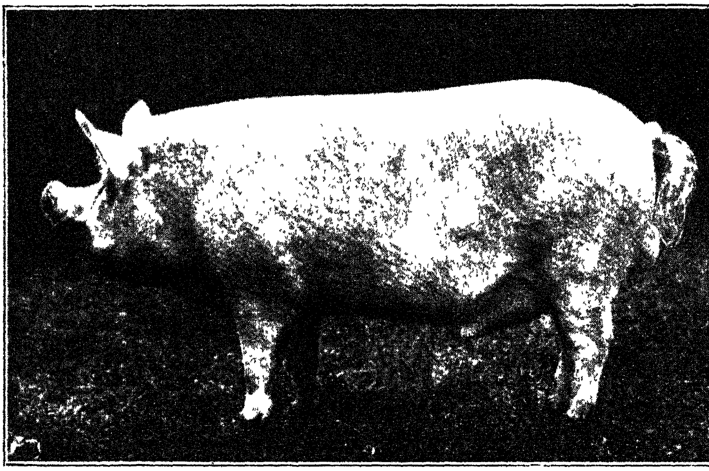


PLATE 94.

Large White Boar, "Creek Bradbury 9th," a prominent prize winner at British Shows. Note light forequarter, long, lean body, and shapely conformation.

It is noticeable that big breeds of pigs are invariably more prolific than small breeds, although big breeds need more attention, and the returns they give are dependent almost entirely on the care given in

PLATE 95.

Large White Sow, "Spalding Belle 41st," bred and exhibited by Mr. Alfred W. White, of the Spalding Herd, Spalding, England. A neat, attractive sow, showing light, neat forequarter, roomy body, and well-developed hindquarters.

feeding and management. A prolific sow is of great value to any farmer. Recently a pure-bred Large White sow in England bred and reared fifty-five pigs in five litters, and later farrowed her sixth litter of twenty-one live pigs. Another prominent Large White breeder there who keeps strict records, shows that in 1933, thirty-three farrowings produced 378 pigs, and an average of 11·45 per litter. Of this number 305 were weaned, an average of 9·24. Thus 80 per cent. of the pigs born were reared.

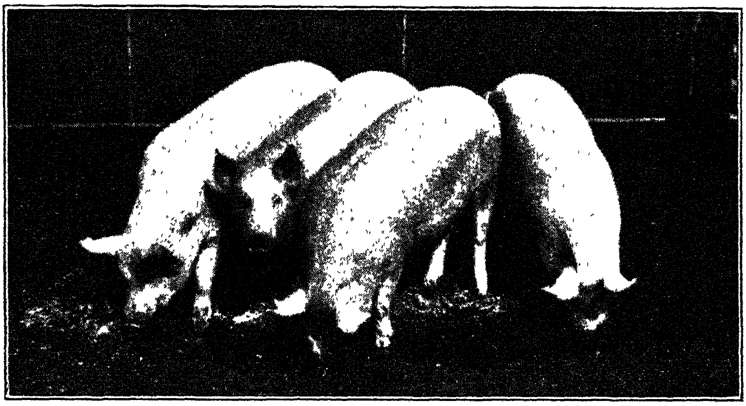


PLATE 96.

Group of Large White pigs, who put up a good record in the Minnesota Record of Performance Test, U.S.A. Average daily gain in weight over period of test, 1.40 lb. Total foods per lb. live weight increase, 3.42 lb. Good growers of desirable conformation.

The Queensland record for a Large White appears to be held by Kingston Patricia 1346, a well-known prize-winning sow. She has had six litters—of 11, 15, 15, 15, 15, 15. She had her sixth litter before three years of age, and at that time was still in a productive profitable condition.

The Large White as a Baconer.

The suitability of any breed or cross for pork or bacon factory requirements is dependent almost as much on feeding and management as on breeding, although it is virtually impossible to make a bad pig a profitable one. The long lean side of the Large White is the feature that appeals to bacon curers; in addition, the fore quarter is light and fleshy while the ham is reasonably proportioned and can be improved upon by judicious crossing with breeds whose hams show more cushion and thickness. Desirable crosses include the Large White boar on Middle White or Berkshire sow, or on selected grade sows showing similar type.

For Queensland bacon markets, it is desirable that this system of crossing be followed, for if the Large White is crossed with the Tamworth, it is most difficult to finish the pigs for factory requirements within the weights required. For the export markets these more growthy, larger-framed pigs can be matured to advantage, but it is useless attempting to mature such pigs as porkers or lightweight baconers except at an expense in feeding that is not warranted.

Selection of Boar and Sow.

In the selection of boar or sow, special attention must be given to securing animals possessing a sturdy constitution, a quality denoted by a wide, deep, capacious chest, width between the eyes and ears, strong, straight forelegs wide apart and set well on the outside of the body. No tendency to inbent or weak knees should be allowed. The shoulders must be light, back long and straight with well-sprung ribs, roomy barrel and deep sides, hams thick and compact in comparison with size of animal, tail well set upon the rump. Both boar and sow should show twelve to fourteen or sixteen well-developed teats, with a deep level underline. Flanks must be deep and loose. The coat of hair must be thick, straight, and silky. A tendency to curly coat often indicates coarseness and, like short stubby hair, is undesirable. The head must be well developed, not too large and ungainly, but neat and attractive, the

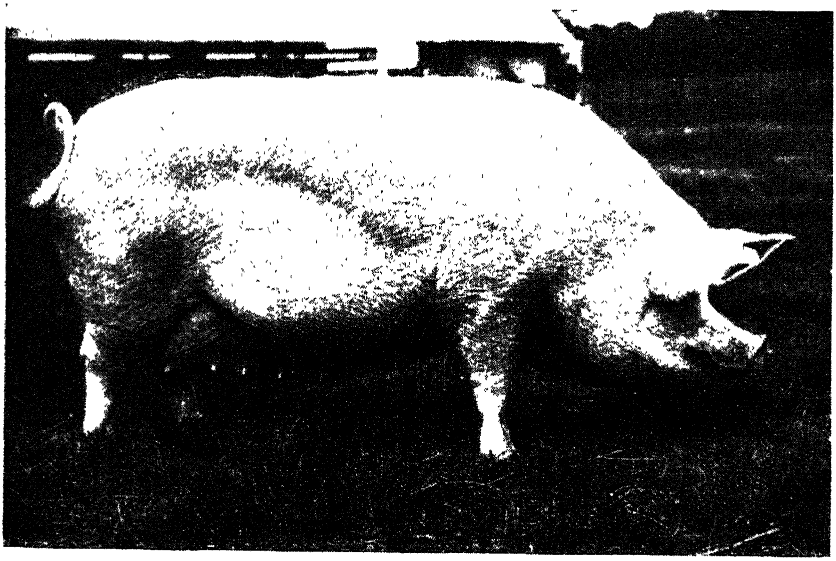


PLATE 97.—LOCKWITH BLACKBERRY, 8TH.
A championship prize-winning sow at British Shows. A matron of superior quality.

face slightly dished, the snout of medium length and somewhat pointed, the muzzle broad, eyes bright and kindly, the jowl light and running well into the neck. The ears should be of medium size and but slightly inclined forward and fringed with fine silky hair. The boar's breeding organs must be well developed—no sign of rupture or of abnormal swellings being allowed to pass without critical inspection. Never use a boar showing any weakness in this respect, as any weakness would probably be of an hereditary nature; look for quality both in flesh, skin, and hair, and rigorously cull any stock not coming up to the standard.

It is only families that are prepotent, prolific, vigorous, and contented that should find a place in the herd. Heavy shouldered, thick-set types are most objectionable in these long-bodied breeds, and invariably lack the powers of prolificacy and quick growth without which the Large White would soon prove unsuitable.

Litter Weight Performance.

Claimed as an Australian record for a Large White sow's production record the sow, "Vaucluse Jewel 5th," 840, has put up a record difficult to excel. Her pigs were produced and handled under official control, the figures being certified to by Victorian Government officials. The sow herself is a prominent prize winner, and is of a very prolific and productive type. She is registered and was bred in Victoria and a large number of stud stock have been selected from her litters, whose records are as follows:—

Litter Weights at Twenty-six Weeks of Age from Sow, "Vaucluse Jewel 5th."

1st litter, total weight at 26 weeks	2,400 lb.
2nd litter, total weight at 26 weeks	2,506 lb.
3rd litter, total weight at 26 weeks	2,375 lb.
4th litter, total weight at 26 weeks	3,187 lb.

or a total litter weight (reared to 26 weeks each litter) of 10,468 lb. within two years.

PLATE 98.—WALL BEAUTIFUL 11TH, 191626.

Supreme championship winner in Large White breed, Royal Agricultural Show, England, 1932. A wonderful sow in every way. Note her capacity to rear and suckle and her well-developed hindquarters.

Records such as these indicate what can be done by efficient feeding and control of a type of stock capable of quick and economical growth. It is well to remember, however, that such records cannot be expected in the absence of a sound knowledge of the business of pig-feeding and an understanding of the qualifications of the type of pig handled.

The Federal Council of the Australian Stud Pig Breeders' Society has adopted the following "Standard of Excellence" and Scale of Points for Large Whites:—

	Points.
Head and Ears.—Moderately long; face slightly dished, not too much turned up, wide between ears; jowl not heavy; ears long, thin, slightly inclined forward, and fringed with fine hair	15
Neck and Shoulders.—Long and full to shoulders, deep to chest; shoulders level across top, not wide, free from coarseness ..	10
Back and Sides.—Long, level, and wide from neck to rump; loin broad; ribs well sprung; sides deep, well let down to flank, with straight underline; and, in sows, twelve good evenly-placed teats	20
Hams.—Broad, full, and deep to hocks; tail set high, stout and long, but not coarse, with tassel of fine hair	20
Legs and Feet.—Straight and well set, level with outside of body, with flat bone; pasterns short and springy, with feet strong, even, and wide	15
Colour, Skin, and Hair.—Hair white, free from black hair, and as far as possible free from blue spots on skin; skin fine, free from wrinkles; hair long and moderately fine	10
Character.—A combination of all the points showing distinctive breeding, type, and quality	10
Total points allowed	100

CATTLE FEED RACK.

Here is a sketch of a cattle feeder which will hold a fair amount, and keep the animals in comfort during cold winter nights, without waste of fodder. Figure 1 is designed of sawn timber. The frame is 6 feet wide, 6 feet high, and 8 feet long, built on runners to be easily moved about the yard. The pickets are 6 feet long, so that they project 18 inches to 20 inches above the top of the frame. The picket frame is open at the bottom about 18 inches, to let the hay down on to the A-shaped elevated divider in the centre of the floor, which helps to distribute it within reach of the calves. The tight floor is boarded round with a rim of 4 by 2 to prevent waste of the finer particles of grass, hay, or lucerne hay. It may be boarded up higher to

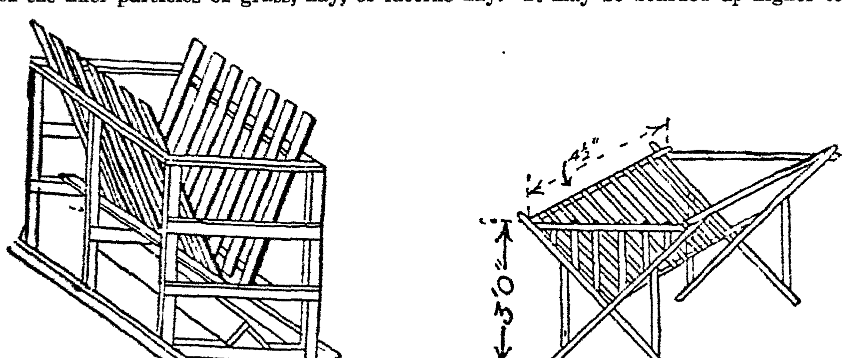


Fig. 1. Fig. 2

PLATE 99.

make of the lower floor a feeding trough for grain or silage. Should a cover be thought necessary, the end post may be made higher to carry the roof, the hay being then filled in through the gable ends. If the present top bar on the end posts were made to swing it would facilitate filling the rack. Figure 2 shows a feed rack of a bush type for feeding lucerne, &c., to sheep. It is 6 feet long, 3 feet high to the top bar, and the slats are 4½ inches apart. In the sketch, for the sake of clearness, the open sparwork is shown only on one side and one end. Some dairy farmers do not like the overhead racks, and might prefer the bush rack even for cows.

The Problem of Youth.

ST. LUCIA FARM SCHOOL.

By J. F. F. REID.

NO nation can afford to allow a generation to grow up in idleness. So priceless a heritage is the right to work for an independent living and for personal liberty that it is worth every sacrifice we can make for the full-time employment of the mind and muscle of our youth—Australia's manhood of to-morrow.

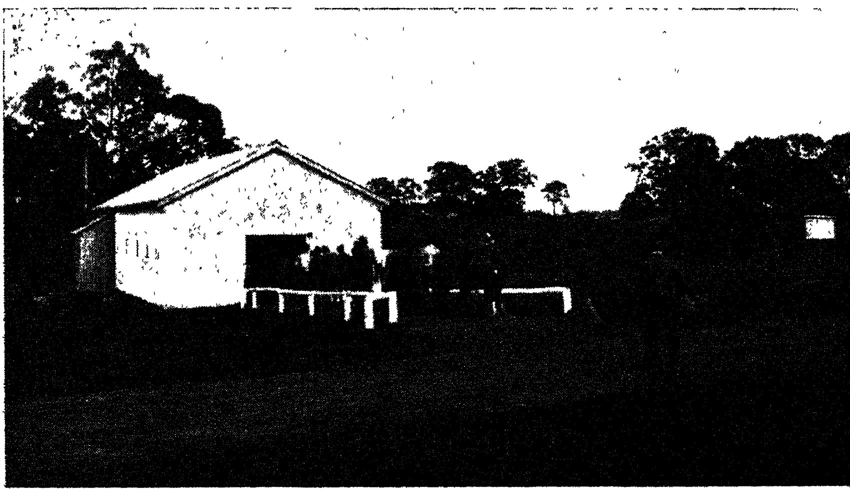


PLATE 100.—A POPULAR RENDEZVOUS.
The Dining Hall muster for the midday meal. The St. Lucia menu is, probably, unexcelled at any other boarding school in Queensland.

A realisation of those facts was the force behind the establishment of the St. Lucia Farm School, and is still the impelling force behind further efforts of the Departments of Agriculture and Stock, of Labour and Industry, and of Public Instruction. Co-operating with the Government in its search for a solution, in part at least, of the biggest problem confronting the nation—the problem of unemployed youth—are the Churches, the New Settlers' League, the Legacy Club, the Rotary Club, and other social organisations.

The Story of St. Lucia.

Two years ago a conference of representatives of the Departments and social organisations named was convened by Mr. Frank W. Bulcock, Minister for Agriculture and Stock. At that conference Mr. Bulcock outlined a project for the establishment of a farm training school at a place convenient to the city, at which boys with no immediate prospect of absorption in industry, and without previous rural experience, might be trained for a life on the land. Addressing the conference, the Minister said, *inter alia,* that there were many reasons why a State must engage in an active "young man's land movement" under proper conditions.

PLATE 101.—GROUP OF TRAINEES, ST. LUCIA FARM SCHOOL.

Seated in the centre of the front row (left to right) are Messrs. A. J. Bowman (Farm Foreman) and F. Skinner (Queensland Agricultural College). The Supervisor, Mr. J. A. Kerr, was absent at Moggill with a large party of boys who are undergoing a course in practical bushcraft, when the photograph was taken.

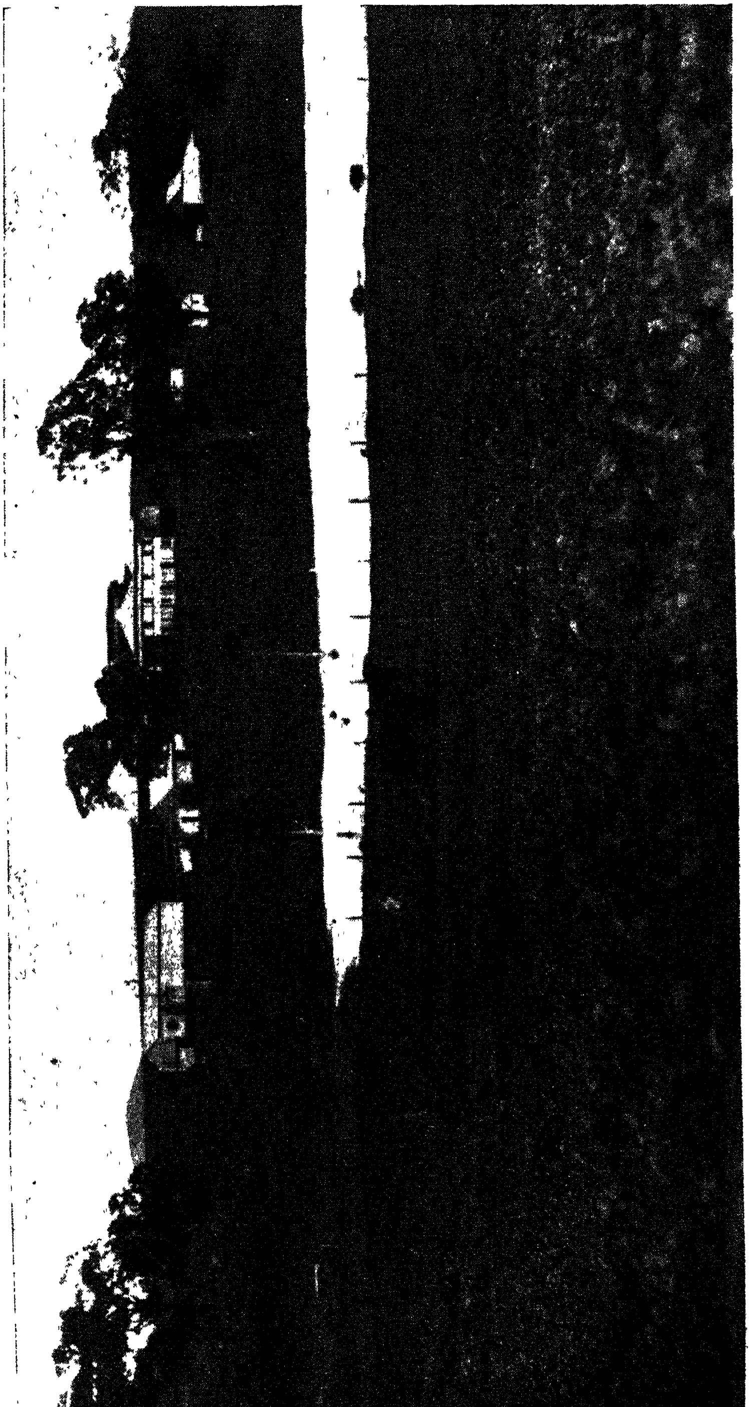


PLATE 102.—A GENERAL VIEW OF THE ST. LUCIA FARM SCHOOL BUILDINGS.

From left to right—The Dining Hall, Cook's Cottage, Office, Store, Staff and Trainees' Quarters (centre), Poultry House, Hay and Milking Sheds.

PLATE 103.—POINTS OF A GOOD "PODDY."
A Dairy Instructor demonstrating at St. Lucia Farm School.

PLATE 104.—A RIVERSIDE RURAL SCENE AT ST. LUCIA.
Fodder cultivation and conservation is practised as well as preached at the Farm School.

First, if they agreed that the limits of production had been reached, then there was no hope in the future for Queensland, in common with Australia generally. They could not escape their agricultural destiny, and therefore must wisely direct it. Wise direction must be the very opposite to the policy of despair that was associated with restriction of land settlement. Rather must they continue to produce with skill and distribute with wisdom. Queensland was a primary producing State, and while they were labouring under a cloud of depression it was natural to expect that their primary industries would suffer, but economic surveys had shown that periods of depression alternated with periods of prosperity. One of the great difficulties confronting the statesmen and economists of the world was the regulation of phases of economic interplay and the evolution of a system whereby a general satisfactory

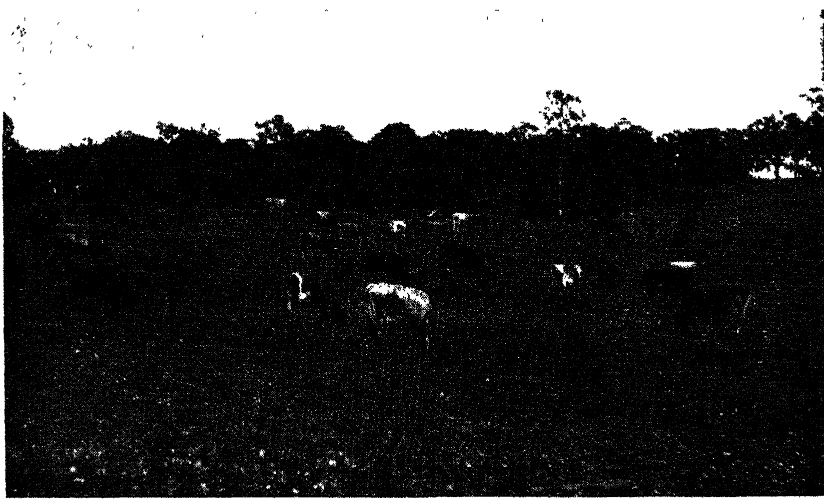


PLATE 105.—GRAZING DOWN THE STUBBLE.

On St. Lucia is a fine herd of thirty dairy cows, grade Jerseys, mainly. Sound dairy management is practised at the Farm School, and this picture shows the cows grazing contentedly on the stubble of an oat crop recently harvested.

average should be obtained. That surely was not beyond the ability of mankind, and agricultural history of recent years had shown distinct evidence of stabilisation. Australia could never agree to a policy of general limitation of production, and he believed that that phase, which was associated so closely with present circumstances, would pass away with the passage of the conditions that had given rise to the advocacy of restriction. The time, therefore, had arrived to prepare for the farming future of the State, and the material to employ was the youth, both of the country and the city.

A survey of immediate prospects could not encourage parents to hope for the speedy employment of their sons in industrial occupations. Queensland had the lands and had the adaptable youth, but the difficulty of bringing both together was difficult of adjustment. He believed it rested particularly in an appreciation on the part of the parents of the merits of an agricultural career for their sons, the promotion of a land

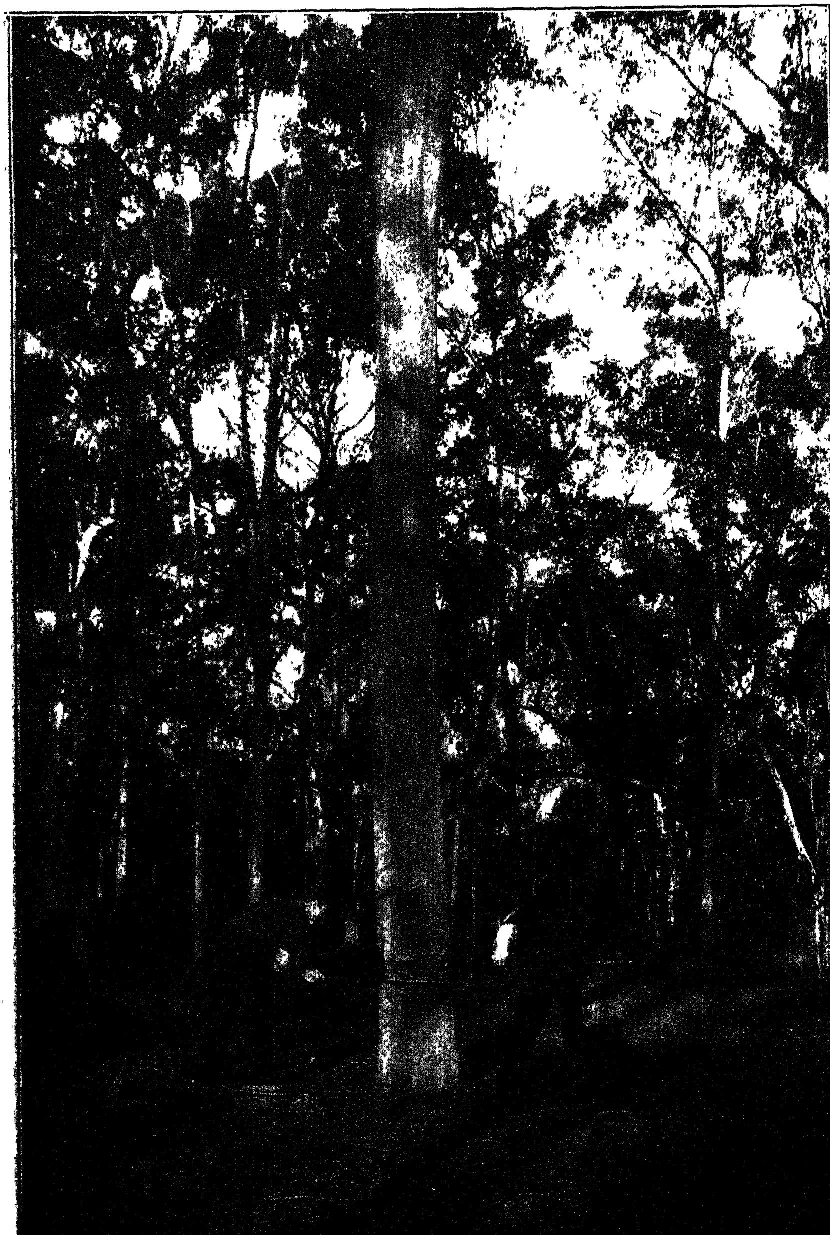


PLATE 106.—SAWING THE BACK CUT.

St. Lucia Trainees are taught various branches of bushcraft in the Queensland University forest lands at Moggill.

PLATE 107.—STAND CLEAR FOR THE CRASH!
The falling tree was belly-scarfed and sawn by St. Lucia Farm Trainees in 7¼ minutes.

PLATE 108.—BARKING THE FALLEN LOG.
Preparatory to sawing it into fence-post lengths.

PLATE 109.—ENTERING A WEDGE.
St. Lucia Trainees engaged in splitting fencing timber.

consciousness in the city youth, and a recognition of the channels through which a boy should pass in order to become a farmer.

Mr. Bulcock then sketched the project he had in mind for the establishment of a farm training school at which, under pioneer conditions, boys who were unable to obtain regular employment, and who were likely to develop landmindedness, might undergo a rudimentary course in agriculture and so qualify for employment in rural pursuits.

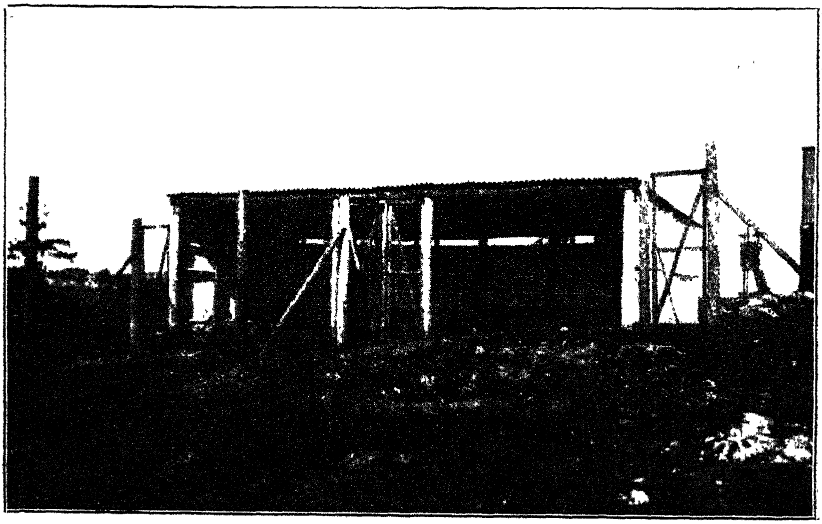


PLATE 110.—POULTRY HOUSE AND PENS AT ST. LUCIA.
All buildings and dividing fences were erected with material from the Moggill forest by Trainees as part of their general course of instruction.

The conference commended the project unanimously, and appointed a number of committees to advance it to a concrete stage. The Queensland University offered the use of its lands at St. Lucia and Moggill, which it acquired some years before as a University site through the generous and public spirited gift of Dr. and Miss Mayne. Fifty or sixty years ago this land was under sugar-cane and other crops, and a considerable portion of it consists of fertile river flats, and it is otherwise well adapted for the purpose of a farm training school. As the University is not likely to occupy the area for some years to come, it is the general belief that it could not be put to better immediate use than that of a training ground for potential primary producers.

The four committees appointed—organising, curriculum, admissions, and employment—set to work at once on the details of the scheme, and by the following January the training farm became an accomplished fact. It is significant that it has not been necessary to call the employment committee together since the launching of the scheme, for the demand for youths trained at St. Lucia is far greater than the supply.

A Farm Within A City.

A ten-minute motor run takes one from the heart of the city to the pleasant rural scenes of St. Lucia, situated within a hair-pin bend of the beautiful Brisbane River. There are several ways of approach, and the

most direct is by tram to West End, thence by ferry across the river. The nearest way by road is through the riverside suburb of Toowong, but the most interesting route runs through Taringa along Swann road and the crest of a forested ridge from which magnificent vistas stretch away beyond the Peak Mountains, near Ipswich, to the great mountain masses of the Macpherson Range, discernible in the mist-filmed distance and bordering New South Wales. Northward the outlook takes in the whole of the city proper with its lofty Town Hall tower dominating the lesser spires and domes. Westward, forest-clad spurs rise to the bold escarpment of Mount Cootha and the wooded crests of its parent range. Below is the wide sweep of a pretty reach of the river curving in conformity with its serpentine course. On the further bank and back of it is picturesque Yeronga rising to the hills of Tarragindi, and Dutton Park clinging to the steep slopes that ascend to Dornoch Terrace. The sun-silvered surface of upper river reaches glistens amid fields of emerald enamel, specked with the ruby roofs of bungalowed suburbia. A turn of the road and St. Lucia Farm comes within this view of a city beautiful and its glorious environment.

From the entrance gate a long lane leads to a cluster of farm buildings. Away to the right a football field claims a stretch of level land, and nearer at hand is a well-constructed tennis court. A well-conditioned dairy herd is grazing contentedly on the stubble of an oat crop. Curving round the river bend are fields of lucerne and other fodder crops, contrasting in their intense greenness with the native pasture, frosted yellow. Out on the farm boys are busily ploughing, harrowing, and fencing; from the vegetable garden on the further side of the lagoon the earth-polished blade of a hoe flashes intermittently in the sun.

A Training Farm Established.

St. Lucia Farm School was founded by Mr. Frank W. Bulcock, Minister for Agriculture and Stock, and opened by him on 31st January, 1933. Fifty youths, ranging in age from seventeen to twenty years, all from the Brisbane city area, were enrolled. That enrolment, with occasional additional increases, has remained practically constant ever since. In accordance with the original plan, half the boys were admitted as boarders and half as day trainees. Mr. F. O. Bosworth, B.A., of the staff of the Queensland Agricultural College and High School, from which he was seconded for a term, was the first Officer in Charge. On the completion of his term Mr. Bosworth returned to the College, and Mr. J. A. Kerr, a graduate of that institution, was appointed Supervisor of the Farm School.

The curriculum of the Farm School is planned on broad lines, with the idea of giving the boys a thorough grounding in the rudiments of ordinary farm routine. Instruction is given in all branches of dairy practice, pig raising, poultry keeping, and general farm field work.

The farm contains about 170 acres, consisting of undulating country and fertile river flats. The soil on its arable area is mostly sandy loam with some heavy alluvial patches. It is well adapted for dairying and mixed farming. At present 32 acres are under cultivation, of which 5 acres have been designed as pasture improvement plots for both instructional and experimental purposes. Fodder crops are grown and conserved. English potatoes, sweet potatoes, pumpkins, and arrowroot

PLATE 111.—HIS FIRST LESSON.

There is knack in holding the plough handles, with the risk of a knock on the solar plexus, as the farm learner soon finds out.

[*Photo. by courtesy of the "Telegraph," Brisbane.*

Plate 112.—A Tough Task.

Cross ploughing new land matted densely with paspalum. The picturesque suburb of Yeronga is on the further river bank.

PLATE 113.—OPENING A FRESH FURROW.

The heights in the distance are on the other side of the river at Dutton Park. Wild ducks and other aquatic bird life find sanctuary in the lagoon at St. Lucia.

PLATE 114.—WIELDING THE MAUL.

A temporary stake fence to enclose a fine sward of Italian rye grass (right) on St. Lucia, in course of erection.

are also grown, the lastmentioned being used as pig feed. Irrigation—a spray system—is practised in an extensive and well-cropped vegetable garden. An extensive plantation of Queensland nuts has been established, and within a few years these beautiful and profitable native trees should form a striking feature of the St. Lucia landscape. The farm is practically self-supporting, and in the general dining hall at St. Lucia meals probably unequalled in quality and quantity at any other boarding school are served.

The boys find healthy and interesting recreation on the football ground, tennis courts, and in a reading-room in which a radio set has been installed. Daily and weekly papers are supplied through the courtesy of the management of each of the three Brisbane dailies.

Besides the farm at St. Lucia, there is a tent camp in forest country at Moggill, also University land, to where working parties are taken from time to time for instruction in bush craft and pioneering, including the use of the axe, crosscut saw, and maul and wedges. From this camp is supplied all the fence posts and round building timber required at St. Lucia. Groups of boys are also taken, from time to time, to Beerburrum, where they receive tuition in tobacco cultivation and the curing and grading of tobacco leaf. Accompanied by an instructor, the boys also visit, on occasion, the Roma Street Markets, the Kingston Butter Factory, and a commercial pig farm in its neighbourhood. Field officers of the Department of Agriculture and Stock visit the farm, as required, to lecture on dairying, pig raising, poultry keeping, agriculture, fruit and vegetable growing, chemistry of the soil, botany, entomology, and plant pathology.

Piggeries, portable and permanent, have been built by the trainees on the farm in conformity with the general instructional programme. Brood sows of the Large White, Tamworth, and Berkshire breeds are housed, and litters of pedigreed and crossbred pigs are raised for the purpose of instruction in piggery management.

A fine dairy herd, grade Jerseys, running on the St. Lucia pastures supplies milk and butter to the establishment. Both disc and mouldboard ploughs are used in the cultivation of a large acreage. Standing crops of winter cereals, mangels, maize, lucerne, vegetables, and fine swards of introduced grasses are evidence of the industry of the trainees and the practical nature of the instruction they receive.

At the end of July last year the first group of trainees completed their course in the rudiments of rural industry, and were quickly absorbed in farm employment. Since then the demand for boys trained at St. Lucia has far exceeded the supply. It has been so arranged that every quarter half the personnel of the establishment is available for engagement in country jobs, and the boys are placed immediately. As each group leaves a similar number is enrolled to keep the establishment up to full strength.

Scholarships Awarded.

At the end of every quarter an examination is conducted by officers of the Department of Agriculture and Stock for the purpose of selecting a lad for a free scholarship at the Queensland Agricultural College and High School at Gatton. Five scholarships have already been awarded. The reports of the examiners invariably contain comments on the high standard attained by the candidates. This is not surprising,

PLATE 115.—SIGHTING A LINE OF FENCING.
Example of practical instruction at St. Lucia Farm School.

PLATE 116.—THE END OF THE SWING.
Driving stakes in a temporary fence to enclose a pasture plot.

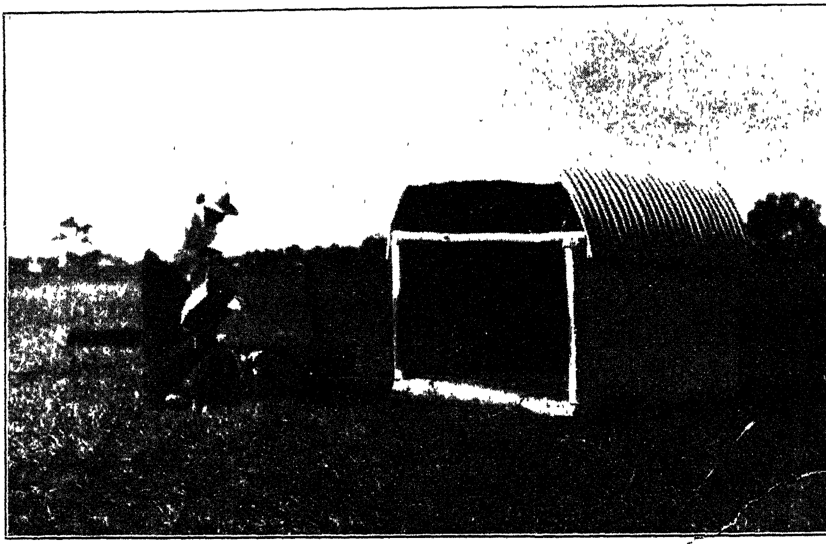


Plate 117.—Feeding the Morning Milk to a Hungry Litter.
Piggery management is part of the curriculum at St. Lucia Farm School. The portable shelter was constructed by the boys from scrapped material found on the farm.

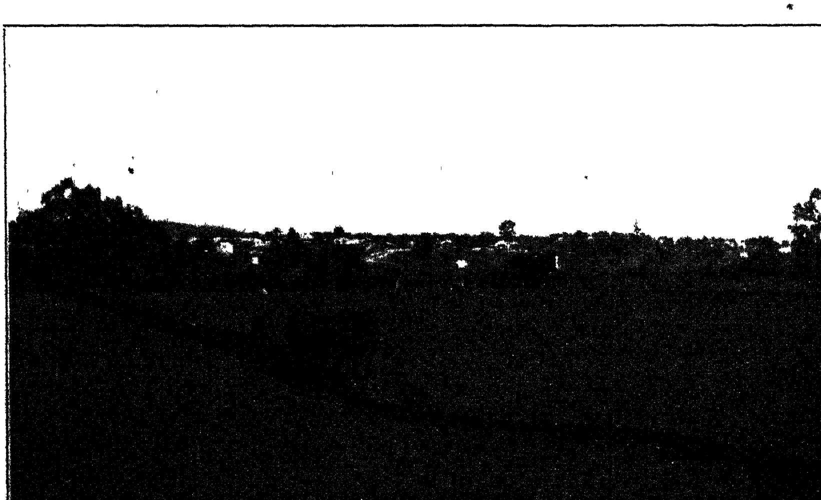


Plate 118.—Preparing Land for Lucerne.
Plough teams in charge of Trainees at St. Lucia.

Plate 119.—Youth at the Plough.
Learning to open a straight furrow at St. Lucia Farm School.

Plate 120.—Giving the Horses a "Blow."
A scene on St. Lucia. The lad was receiving his first lesson in ploughing and the handling of a team. Mount Coot-tha and D'Aguilar Range in the distance.

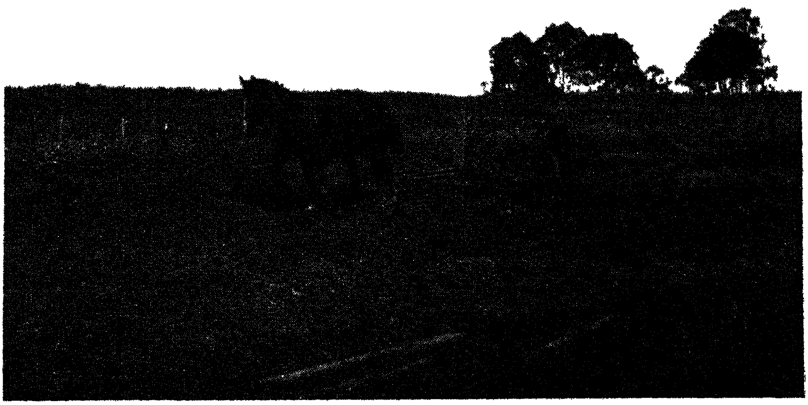


PLATE 121.—BREAKING DOWN THE CLODS.
Every branch of farm field work is included in the school programme.

PLATE 122.—PREPARING LAND FOR ANOTHER CROP.

PLATE 123.—PICKING PEAS FOR THE PANTRY.

St. Lucia Farm School is practically self-supporting in respect of food supplies.

PLATE 124.—AT THE END OF A WELL-CROPPED CABBAGE ROW.

for many of the trainees have passed the State Scholarship Examination and have been educated up to the Junior University grade. The successful candidate is awarded a twelve-months' scholarship at the College at Gatton, and is given the opportunity of gaining an extension of the scholarship for a further term. For the boy who realises, as some of them obviously do, that "The Chance of a Lifetime is only during the Lifetime of the Chance," the extension scholarship may lead on to the Agricultural Faculty of the Queensland University. Thus the gate of opportunity is wide open to the boy who passes through St. Lucia.

Conditions of Enrolment.

Parents who desire that their boys should enter the school should place themselves in touch with the Interviewing Officer (Mr. J. Kilmartin), Department of Agriculture and Stock, William street, Brisbane. Trainees are accepted at any age between fourteen and twenty-one years. The boys pay no fees, and receive free board. Farmers who desire to engage the services of the youths at the end of their training term should communicate with the Lads' Employment Bureau, Box 1448 T., General Post Office, Brisbane. The boys represent a fine type of Australian youth—keenly intelligent, country-conscious, active, energetic, and imbued with an excellent spirit. Their general standard of conduct is high, and the staff has succeeded in establishing a good tone in the farm school, to which the character and calibre of the young trainees responds very readily. Reports from farmers who have St. Lucia trainees in their employ are, invariably, highly appreciative.

The foregoing, briefly, is the story of St. Lucia, which, it is believed, is measuring up to the ideal of its founder and fulfilling the hopes of the interested citizens who support him in what is regarded as an important social movement designed to counter the effects of the existing economic situation—to some extent, at least—by directing the youth-power of the land into fields of primary production. The main idea behind the scheme, the success of which was never doubted and which has already been amply proved, was to give workless city boys an opportunity of training for a country career.

The problem of youth is to find fitting opportunities for youth on the threshold of youth's career. We have suffered the years of economic depression in common with every other country, but the inherited spirit of Australians is such that it would take many more years of deferred hope to damp the ardour of Young Australia. These boys of ours are game and willing. They are ready; they are prepared. Therefore, Queensland must give them their opportunity. There is plenty of room in Australia, there are "potentialities" to absorb the energy of millions. To find in this field the chance for our own young people is the present and most pressing duty of the nation. The farm school at St. Lucia—to which may soon be added similar institutions in other parts of the State—is, at least, some evidence of our acceptance of that duty.

Agricultural Notes.

H. W. BALL, Assistant Experimentalist.

MILD winter conditions continue up to the time of writing throughout the coastal agricultural areas, and following on the good season experienced the usual decline in pastures and consequential dairy production has not been unduly pronounced. Acting in accordance with Departmental advice, an increasing number of farmers are supplementing their reserves of fodder by early and successive sowings of winter crops, such as barley, oats, and wheat, thereby maintaining production and keeping stock in good condition throughout the period of natural scarcity of feed. The sowing of lucerne and winter grasses is also receiving greater attention, and experience thereby being accumulated of those species which are likely to give the best results in the various districts.

PLATE 125.

A FIELD OF "NOVO" WHEAT AT WILLOWVALE, DARLING DOWNS.

"Realisin' he was wealthy in what makes a life worth while."

Wheat.—The outlook for the present season is uncertain, as, owing to dry autumn conditions throughout the chief producing areas, early cultivation was retarded, and this fact, in conjunction with the low price levels prevailing, is likely to result in a reduced acreage being sown. The Dalby district experienced more favourable conditions, many hundreds of acres of new land being sown, and crops in this area are generally in good heart. In the Clifton district it was necessary to feed off the rank growth of early-sown crops after the July rains, whereas in the Warwick district and the Maranoa considerable areas have had to be replanted. From the above remarks it will be noted that the season, to date, has been rather patchy.

Sugar.—With mid-winter conditions prevailing in all cane areas, very little crop growth was recorded for the month of July. No serious frosts have been reported, however, and it is now certain that little damage will be inflicted from this cause, as practically all mills are operating. Fortunately, the absence of heavy rains in the far North has enabled the farmer to push ahead with his land preparation for next year's crop; planting has been unduly delayed in these parts.

The milling returns to date show that the sugar content of the crop is high, in contrast to the low values recorded last year. It is as yet too early to revise the preliminary crop estimates, as much will depend on the growing conditions experienced in the early spring months.

The cane planted prior to the winter has given, in general, satisfactory germinations and the early-planted crop is finding conditions favourable for its development.

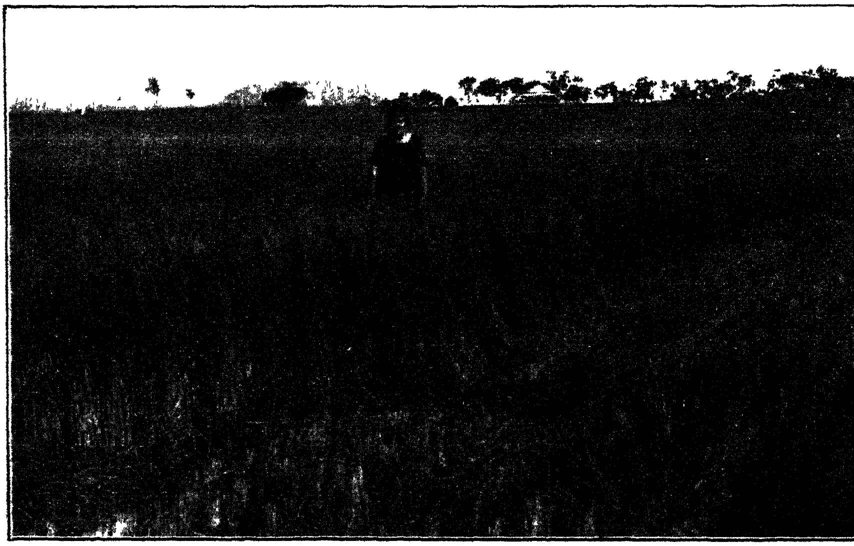


PLATE 126.

"THREE SEAS" WHEAT AT FREESTONE, DARLING DOWNS.

"When the settin' sun is gettin' low above the western hills,
When the creepin' shadows deepen, and a peace the whole world fills."

Cotton.—The harvesting of the cotton crop has continued at a good rate during the month, heavy receivals having been experienced at both ginneries. The total amount of seed cotton sent in by the end of July will approximate 23,000,000 lb., which is nearly 28 per cent. greater than the previous record crop for the State. Considerable cotton still remains to be harvested, and it appears likely that the total for the season will be in the neighbourhood of 25,000,000 lb. of seed cotton, which will be obtained from, roughly, 50,000 acres grown by 3,100 growers. The average yield will be a decided improvement over those of the previous three seasons, when such disastrous drought conditions prevailed. Had the entire months of January and March not been dry a much higher average yield per acre would have been

obtained, for, at the end of December, the possibilities were most promising of obtaining exceptionally high yields in most of the districts.

The dry weather following the frosts in mid-June has hastened the opening of the top crop, which will thus allow of the cutting off and burning of the plants in time to start the preparation of the new seed beds in good season. The results obtained in this crop, however, would indicate that it is advisable to plant at least a portion of the cotton area on either newly-brought-in cultivation out of grass land, or following some fodder crop, for apparently a greater factor of safety exists against seasonal variations where cotton is grown on such soils as compared to where cotton has been grown for several seasons in succession.

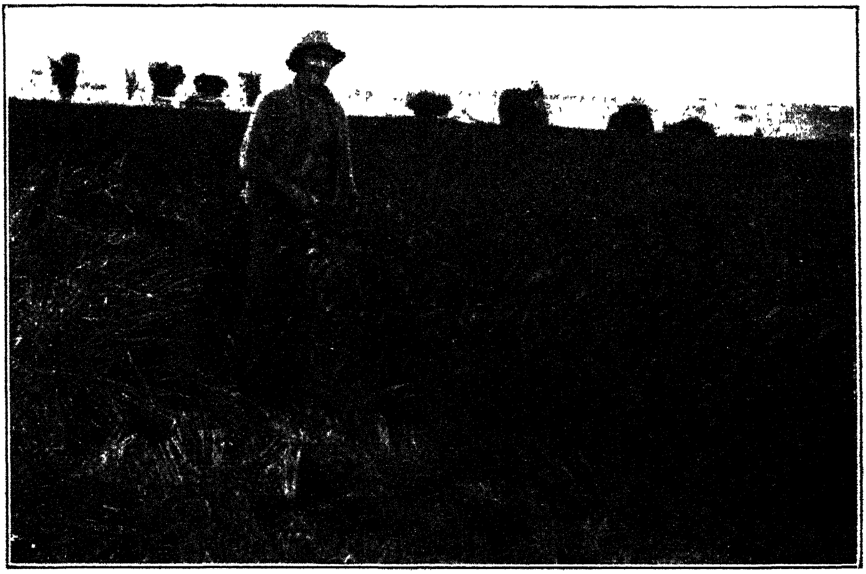


PLATE 127.

"WARATAH" WHEAT AT YANGAN, DARLING DOWNS.

" Wheat, Wheat, Wheat! When it comes my turn to meet
Death the Reaper, an' the Keeper of the Judgment Book I greet,
Then I'll face 'em sort o' calmer with the solace of the farmer
That he's fed a million brothers with his Wheat, Wheat, Wheat."

The Director of Cotton Culture advises that planting seed is now being distributed from the Whinstanes and Glenmore ginneries. Before applying for their seed, it is recommended that growers ascertain from the Cotton Section of the Department of Agriculture and Stock, Brisbane, particulars as to the suitability of their soils for growing some of the high lint per cent. medium staple cottons that are being distributed this season. Any inquiries should be accompanied by a full description of the soils on which it is intended to grow cotton, stating whether originally covered with scrub or forest, slopes or alluvials, clay, clay loams or sandy loams, number of years under cultivation, and the name of any variety of cotton that has given good results on the plot or on similar soils in the district.

Maize.—Harvesting of this crop has now been completed. Late-sown maize is very accommodating in this respect, as, given normal weather, it will stand over well into the winter. Although not a record, the returns are over the average, the crop being estimated at 4,500,000 bushels. In the Atherton district a reduced acreage was sown, and the yields also reduced by the excessively wet conditions. The low values being obtained for maize and other grain crops provide an excellent opportunity for stockowners outside the farming areas to purchase stocks which can be stored against the inevitable periods of drought.

Tobacco.—Curing is nearing completion, and grading is being carried out both on farms and grading sheds. Some good-quality leaf has resulted and sales made at satisfactory prices, a choice parcel of northern leaf bringing 4s. per lb. at a recent sale. Although the present season's production has fallen considerably below that of 1933, chiefly owing to the heavy rainfall, growers generally are optimistic, and the experience gained will be of value; so a gradual expansion of the industry on sound lines may be confidently anticipated. In the Mareeba and adjacent districts, peanuts are likely to become a good subsidiary crop for tobacco-growers, as yields of up to a ton per acre of good-quality nuts have been obtained where suitable fertilizers have been used.

Markets.—Fair values have been maintained for primary produce, although lucerne hay, chaff, and protatoes have been in heavy supply. Good-quality potatoes have brought over £11 per ton. At this season a large quantity arrive from the Southern States, particularly for seed purposes, and owing to the condemning of some consignments an exchange of Inspectors under the Diseases in Plants Act with Southern Departments of Agriculture has been suggested, so that an increased knowledge of the market requirements and also greater immunity from introduced disease may be obtained.

All stock are reported to be in good condition and sound values maintained.

Draught horses are in demand and have brought exceptionally high prices at various Downs centres, over £30 being paid for good animals.

A FORMULA FOR WHITEWASH.

Obtain, if possible, large pieces of fresh lump lime, place them in a very large bucket or other suitable container, and into this pour hot water. Cold water will do, but hot water is better, as it hastens the slaking. The lime will start to boil and break up. Keep it covered all the time with about half an inch of water. This is important, for if whilst the lime is slaking it is allowed to rise up above the water in a dry powder it will "curdle," a condition tolerated only by inexperienced and indifferent workmen. Before the lime commences to boil fiercely add tallow or common fat in the proportion of about 7 lb. to 14 lb. of lump lime. This makes a good binder which will prevent the wash from rubbing off. If desired, a little yellow ochre may also be added, which will give a cream or buff tint according to the quantity used. When the lime is thoroughly slaked it should be stirred and sufficient water added to make it a little heavier than, say, milk, after which it should be strained and, if desired, may be applied whilst hot.

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 3rd July, 1934, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for July, August, and September, 1934:—

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 7th August, 1934—"The Packing and Preparation of Tomatoes for Market." By J. H. Gregory, Packing Instructor.

Thursday, 9th August, 1934—"The Avocado in Queensland and Elsewhere." By H. Barnes, Director of Fruit Culture.

Tuesday, 14th August, 1934—"Packing Shed Hygiene." By J. H. Gregory, Packing Instructor.

Thursday, 16th August, 1934—"The Importance of Citrus Bud Selection." By H. Barnes, Director of Fruit Culture.

Tuesday, 21st August, 1934—"Papaw Cultivation." By H. Barnes, Director of Fruit Culture.

Thursday, 23rd August, 1934—"The Pasteurisation of Milk and its Products." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 28th August, 1934—"Vitamins in Dairy Products." By O. St. J. Kent, B.Sc., Analyst.

Thursday, 30th August, 1934—"Factors Influencing the Amount of Fat in Milk." By O. St. J. Kent, B.Sc., Analyst.

Tuesday, 4th September, 1934—"Seasonal Farm Crops," Part I. By C. J. McKeon, Instructor in Agriculture.

Thursday, 6th September, 1934—"Seasonal Farm Crops," Part II. By C. J. McKeon, Instructor in Agriculture.

Tuesday, 11th September, 1934—"Seasonal Farm Crops," Part III. By C. J. McKeon, Instructor in Agriculture.

Thursday, 13th September, 1934—"The Tobacco Industry Protection Act of 1933." By H. S. Hunter.

Tuesday, 18th September, 1934—"Some Requirements of Plant Growth." By E. H. Gurney, Agricultural Chemist.

Thursday, 20th September, 1934—"Fertilizers and Manures." By E. H. Gurney, Agricultural Chemist.

Tuesday, 25th September, 1934—"Nutritive Value of Pasture." By E. H. Gurney, Agricultural Chemist.

Thursday, 27th September, 1934—"Mineral Ingredients in Stock Foods." By E. H. Gurney, Agricultural Chemist.

CARE OF THE WORKING HORSE.

Most derangements of the digestive organs of horses are due to errors in diet, and a good and regular system of feeding will do more than anything else to prevent trouble of this kind. The following rules for feeding are generally accepted as correct:—

Water before feeding, and not for at least an hour after.

Feed in small quantities, and often.

Do not work hard immediately after a full feed.

Never give a horse food to which it is not accustomed in large quantities.

If these rules are followed, and care taken to ensure that only sound, good food is fed, very little trouble will be experienced.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Ayrshire Cattle Society, production charts for which were compiled for the month of June, 1934 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (OVER 5 YEARS OLD), STANDARD 350 LB.				
Scarlet XII of Springdale	V. Dunstan, Wolvi	12,208·15	583·757	Don of Springdale
Springleigh Primrose	Moller Bros., Boonah	12,924·95	567·101	Kelston Warrior
Queenie 3rd of Glengarry	G. Waugh, Peeramon	12,469·8	477·794	Jambaroo Glengarry
Model XX of Springdale	V. Dunstan, Wolvi	11,356·35	407 877	Lovely's Commodore of Burradale
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Happy Valley Bangle 2nd	R. R. Radel, Coalstoun Lakes	7,628·15	330 016	Molly's Hero of Glenthorn
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Stella 2nd of Blacklands	A. Pickels, Wondai	9,824·15	362 410	Hugo of Blacklands
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Rosenthal Dove 15th	S. Mitchell, Rosenthal	5,651·5	253 116	Rosenthal Reward
Kingsdale Tot 5th	A. A. King, Mooloolah	7,711·1	315·408	Express of Burradale
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Mabreen Ivy	V. Dunstan, Wolvi	7,985 45	334·988	Yumbawarra Headlight
Westbrook Bell	W. F. Kajewski, Glencoe	7,592·79	280 162	Sunrise 3rd of Rosenthal
Glenroy Rita	W. F. Kajewski, Glencoe	6,818·23	271 844	Glenroy Kitchener
Westbrook Jinny	F. G. Couper, Westbrook	6,017·96	238 304	Westbrook Ronald
JERSEY.				
MATURE COW (OVER 5 YEARS OLD), STANDARD 350 LB.				
Kelvinside Ideal's Noble Idol (365 days)	J. and R. Williams, Crawford	10,165 65	619·83	Noble of Yaralla

SENIOR, 4 YEARS (UNDER $4\frac{1}{2}$ YEARS), STANDARD 330 LB.				
Arabula's Pet	J. and R. Williams, Crawford	8,766 25	526 617	Golden Boy
Nan 3rd of Woodlands	D. R. Hutton, Cunningham	8,456 48	373·541	Carnation Golden Duke
Rachel's Gem of Inverlaw	R. J. Crawford, Inverlaw	5,909·15	342 228	Linda 4th Millstream Noble 8th
JUNIOR, 4 YEARS (UNDER $4\frac{1}{2}$ YEARS), STANDARD 310 LB.				
Fauvic Flaremist	H. Cochrane, Kin Kin	6,294·89	319·847	Dreamlad of Glencoe
SENIOR, 3 YEARS (OVER $3\frac{1}{2}$ YEARS), STANDARD 290 LB.				
Peg of Newhills	J. Nicol Robinson, Maleny	5,256·4	337·95	Newhills Mascot
SENIOR, 2 YEARS (OVER $2\frac{1}{2}$ YEARS), STANDARD 250 LB.				
Glenview Sultan's Crystal	F. P. Fowler and Sons, Biggenden	6,089·95	352·812	Caryle Larkspur 2nd Empire
Lady of Wingate	L. A. Pierce, Graceville	7,961·16	341·406	His Majesty of Dalebank
Golden Dewdrop of Golden Hill	Chas. Klaus, Mundubbera	5,389·75	275·452	Wattle Hero of Golden Hill
Lucy of Glenrow	F. Nimmo, Rosewood	6,059·5	267 927	Oxford Nero
JUNIOR 2 YEARS (UNDER $2\frac{1}{2}$ YEARS), STANDARD 230 LB.				
Fauvic Double Joy	H. Cochrane, Kin Kin	5,001	290 204	Condong Double Prometheus
Bellgarth Pansy	D. R. Hutton, Cunningham	5,775·75	288·463	Bellefaire Blonde's Bellringer
Glenview Dainty	F. P. Fowler and Sons, Biggenden	5,118 25	287 021	Caryle Larkspur 2nd Empire
Nimbrae Sylvia	F. Nimmo, Rosewood	6,468	281 97	Oxford Raymond
Faith of Arranmore	J. Newman, Caboolture	4,693 4	251 414	Trinity Prince of Wales
Wyreene Olga	D. R. Hutton, Cunningham	4,256 75	232·29	Goldfinder's Prospect of Morago
Trecarne Silver 2nd	T. A. Petherick, Lockyer	5,832·41	355·346	Trecarne Golden King
Waveley Pretty Lady	D. R. Hutton, Cunningham	6,998 93	334 307	Oxford Gem's Noble 2nd
Glenview Victorious	F. P. Fowler and Sons, Biggenden	5,425	314·188	Trinity Officer
Nimbrae Fanny	F. Nimmo, Rosewood	6,027 5	310 504	Oxford Raymond

AYRSHIRE.

SENIOR, 3 YEARS (OVER $3\frac{1}{2}$ YEARS), STANDARD 290 LB.				
Fairview Lady Bess	R. M. Anderson, Southbrook	12,115·85	451·753	Longland's Bonnie Willie 2nd
Fairview Holly	R. M. Anderson, Southbrook	11,005·93	421·389	Longland's Bonnie Willie 2nd

Land for Grazing Selection.

MALVERN HILLS RESUMPTION.

TWO subdivisions of Malvern Hills resumption, situated from 24 to 36 miles south-westerly from Blackall, will be opened for Grazing Selection at the Land Office, Blackall, on Tuesday, 6th September, 1934.

One block, being portion 1, parish of Maindample, comprises an area of 22,220 acres, and will be opened for Grazing Homestead Selection, with a term of lease of twenty-eight years, at an annual rental of 4d. per acre for the first seven years of the term. This selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

The other block, being portion 3, parish of Granby, comprises an area of 17,745 acres, and will be opened for Grazing Farm Selection for a term of lease of twenty-eight years, at an annual rental of 2$\frac{1}{4}$d. per acre for the first seven years of the term.

Each selection must be enclosed, within three years from the date of the license to occupy, with a fence which is both rabbit-proof and marsupial-proof.

The whole area of the resumption comprises black and brown soil downs country with gidyea forest and scrub.

Portion 1 is sufficiently watered naturally, and portion 3 has a sufficient supply of artificial and natural water.

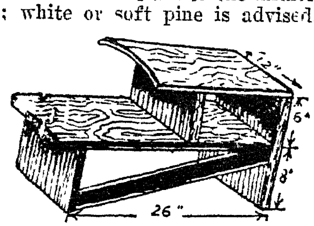
The other improvements consist of fencing.

The improvements on portion 1 are valued provisionally at £1,305, and on portion 3 at £1,425.

Free lithographs and full particulars may be obtained from the Land Agent, Blackall; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence and Tourist Bureaux, Sydney and Melbourne.

MILKING STOOL.

A stool can be easily made that will do away with holding the pail between the knees, and that will prove to be of a real aid to the milker. About 7 feet of 1 by 12 material will be sufficient; white or soft pine is advised, as it is light and is not



easily splintered. Saw up the material you have selected into the following lengths: —One 26 inches, one 18 inches, one 6 inches, one 8 inches, and the back board 14 inches. One end of the 18-inch board should be shaped to fit the curve of the pail. The stool should be braced to keep it rigid. When the carpentering part of the job is done, paint may be applied to preserve the wood and to make the stool more attractive.

Sugar Levies.

(Abbreviated Notice.)

1934 SEASON.

Regulations under "*The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1932," have been approved, providing for levies on suppliers of cane to sugar-mills at the following rates for the season 1934 (the figures for 1932 and 1933 are given for comparison purposes) :—

Name of Mill.	General Levy by Queensland Canegrowers' Council.	Administrative Levy by District Executive.	Administrative Levy by Mill Suppliers' Committee.	Special Levy by Mill Suppliers' Committee.	Total Levies for 1934.	Total Levies for 1933, given for comparison.	Total Levies for 1932, given for comparison.
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Mossman Central	$\frac{3}{4}$	2	..	..	$2\frac{3}{4}$	$2\frac{3}{4}$	$3\frac{1}{4}$
Hambledon	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	..	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$
Babinda Central	$\frac{3}{4}$	$\frac{3}{8}$	..	..	$1\frac{1}{8}$	$1\frac{1}{8}$	1
Mulgrave Central	$\frac{3}{4}$	$\frac{3}{8}$	..	..	$1\frac{1}{8}$	$1\frac{1}{8}$	1
South Johnstone Central	$\frac{3}{4}$	$1\frac{1}{2}$	..	..	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Goondi	$\frac{3}{4}$	$1\frac{1}{2}$	..	..	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Mourilyan	$\frac{3}{4}$	$1\frac{1}{2}$	$\frac{1}{4}$	..	$2\frac{1}{2}$	$2\frac{3}{4}$	$2\frac{1}{4}$
Tully River Central	$\frac{3}{4}$	$1\frac{3}{4}$	..	..	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{3}{4}$
Macknade	$\frac{3}{4}$	$\frac{5}{16}$	$\frac{5}{16}$	..	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$
Victoria	$\frac{3}{4}$	$\frac{5}{16}$	$\frac{5}{16}$	..	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$
Kalamia	$\frac{3}{4}$	..	$\frac{1}{2}$	..	$1\frac{1}{4}$	$2\frac{1}{4}$	$1\frac{1}{4}$
Pioneer	$\frac{3}{4}$	..	1	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Inkerman	$\frac{3}{4}$	..	$\frac{1}{2}$	..	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$
Invicta	$\frac{3}{4}$	..	$1\frac{1}{2}$	..	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Proserpine Central	$\frac{3}{4}$	1	..	..	$1\frac{3}{4}$	2	2
Cattle Creek Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Plane Creek Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Marian Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{1}{4}$	2
North Eton Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Pleystowe	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Racecourse Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Farleigh	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Qunaba	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	$1\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{1}{4}$
Bingera	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	..	$1\frac{3}{4}$	$2\frac{1}{4}$	$1\frac{1}{2}$
Fairymead	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	$1\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{1}{4}$
Gin Gin Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	..	2	$2\frac{3}{8}$	$1\frac{5}{8}$
Millaquin	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	$1\frac{1}{2}$	2	$1\frac{1}{4}$
Isis Central	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	$1\frac{1}{2}$	2	$1\frac{1}{4}$
Maryborough	$\frac{3}{4}$	1	..	..	$1\frac{3}{4}$	$2\frac{1}{4}$	$1\frac{1}{8}$
Mount Bauple Central	$\frac{3}{4}$	1	..	..	$1\frac{3}{4}$	$2\frac{1}{4}$	$1\frac{1}{8}$
Moreton Central	$\frac{3}{4}$	$\frac{1}{4}$	1	$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{4}$
Rocky Point	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{4}$	..	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$
Eagleby	$\frac{3}{4}$	$\frac{1}{4}$	..	..	1	..	..

No poll will be taken in respect of the General Levy of $\frac{3}{4}$d. per ton (first column) for the Queensland Cane Growers' Council, or for the administrative levies by District Executives or Mill Suppliers' Committees (second and third columns).

In the fourth column, the levies on cane supplied to the Marian Central, Pleystowe, and Moreton Central Mills will be used in defraying the costs of employing farmers' representatives at those mills for the current season. In the case of these levies, growers may petition for a poll, and the petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the cane suppliers to the three mills concerned.

In addition to the foregoing levies, the undermentioned Mill Suppliers' Committees are empowered to make particular levies on growers within each of the following districts, at the following rates :—

Name of Mill Suppliers' Committee and Mill to which Cane is Supplied.	Description of District or Cane on which Levies will be made.	Amount of Levy per ton of Cane Supplied.	Purposes of Levy.
		d.	
Racecourse Central	All cane grown on lands assigned to the Racecourse Central Mill and loaded at the Mount Ossa Railway Siding and supplied to the Racecourse Central Mill	3	To be used for financing a farmers' representative at the Racecourse Mill in the interests of the growers paying such levy.
Isis Central ..	Pialba district within the boundaries of the parishes of Urangan, Vernon, and Bingham, county March	1½	To be used for administrative purposes by Pialba Branch of Isis Central Mill Suppliers' Committee.
Isis Central ..	All cane consigned on the railway from Booyal, Junien, and Marule Sidings on the Dallarnil Railway	¼	To be used for administrative purposes by Booyal Branch of Isis Central Mill Suppliers' Committee.
Isis Central ..	All cane delivered in the Cordalba, Huxley, South Isis, North Isis, Childers, Doolbi, and Horton areas.	¼	To be used for administrative purposes by Isis Branch of Isis Central Mill Suppliers' Committee.
Mount Bauple Central	Mount Bauple district within the boundaries of the parishes of Gundiah, Tiaro, Gootchie, Curra, and St. Mary	¼	To be used for administrative purposes by Mount Bauple Branch of Mount Bauple Mill Suppliers' Committee.
Mount Bauple Central	Yerra district within the boundaries of the parishes of Gungaloon, Denison, Doongul, Woocoo, and Young	¼	To be used for administrative purposes by Yerra-Mungar District Branch of Mount Bauple Mill Suppliers' Committee.
Maryborough ..	Pialba district within the boundaries of the parishes of Vernon, Urangan, and Bingham, county March	½	To be used for administrative purposes by Pialba District Branch of Maryborough Mill Suppliers' Committee.
Maryborough ..	Maryborough district within the boundaries of the parishes of Tinana, Maryborough, Bidwell, Elliott, Young, and Walliebum, county March	¼	To be used for administrative purposes by Maryborough District Branch of Maryborough Mill Suppliers' Committee.

Growers are given the opportunity of petitioning for a poll to decide whether or not the above levies shall be made. The petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the cane suppliers within any of the areas concerned.

All petitions must reach the under Secretary, Department of Agriculture and Stock, Brisbane, not later than 23rd July, 1934.

Full particulars of these Regulations appear in the *Government Gazette* of the 23rd June, 1934, or may be obtained on application to the managers of the various sugar-mills in Queensland or to the undersigned—

E. GRAHAM, Under Secretary,
Department of Agriculture and Stock,
Brisbane.

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Useful Native Grass (*Echinocloa Colona*).

O.L.H. (Mareeba)—

The specimen of grass has been identified as *Echinochloa colona*, a native grass with a good reputation as a fodder.

Early Spring Grass.

J.L. (Jackson, Q.)—

The specimen is a species of *Eriochloa* or Early Spring Grass. The genus *Eriochloa* is represented in Queensland by several species. It is under review at the present time, and we find it rather hard to give specific names. However, they are all exceptionally good fodder grasses, much relished and readily eaten down by stock, and grow for the most part during the early spring and summer months. It is certainly a valuable grass in the mixed native pasture, but you will have to rely on natural means of spread, as seed is not obtainable through the ordinary commercial channels.

Silky Oak.

E.C.M. (Ingham)—

The common Silky Oak (*Grevillea robusta*) is very easy of propagation and growth, and if you are raising plants on a large scale you would find it much cheaper to raise them from seed than to purchase plants in pots. The seed is very light, but germinates if kept in special beds or flats in light sandy soil and lightly covered with about ¼ inch or a little more of soil. When a few inches high the seedling plants can be pricked off into pots or tubes. In the Queensland Forestry Department galvanised iron tubes are used for most of their planting, the tubes being split on one side and fastened with a clasp. When the young plant has made fair root development the clasp is undone, and the young plant slid into the prepared hole without the roots being disturbed. Chinese market gardeners and others sometimes adopt the same principle with tomato plants in jam tins, the tin being cut down one side and tied with string. Later the string can be cut and the plant transplanted without any disturbance of the root system. Of course, there is no bottom to the tins or tubes. The common Silky Oak is the old Silky Oak of the trade of Southern Queensland and Northern New South Wales. The Silky Oak of the Atherton Tableland and other parts of North Queensland is a totally different tree, most of the timber coming from *Cardwillia sublimus.*. Seedlings can often be picked up in great abundance on the floor of the northern jungles. If you require further information about soil, the distance apart to plant, pruning, &c., to yield the best timber, we would advise you to write to the Secretary, Forestry Sub-department, Department of Public Lands, Brisbane.

Smartweed.

H.C. (Mackay)—

The specimen is *Polygonum minus*, one of the commonest Smartweeds in Queensland. Smartweeds on the whole, so far as we have observed, are more or less neglected by stock. When they are eaten, however, they are said to cause inflammation of the bladder and the digestive tract. Records of poisoning of stock by Smartweeds are very conflicting, and some veterinarians record the fact that they have fed the plants in quite large quantities without any ill effects following. The symptoms as given by you do not suggest poisoning by this plant, and your letter is being referred to the Chief Inspector of Stock for further advice.

Galvanised Burr ; Mintweed.

S.C.L. (Brisbane)—

The Galvanised Burr is botanically known as *Bassia Birchii.* It is a native of Western Queensland and New South Wales. It is unpalatable to stock, and is one mass of seeds which are easily carried about. On this account it has overrun large areas of heavily stocked county in Western Queensland, and has become particularly abundant on some of the main stock routes. It is a spreading, intricately branched, somewhat woody plant about 2 to 3 ft. high. The stems and leaves are clothed with a white cottony wool, which tends to disappear from the older parts. The leaves are quite small, mostly under half an inch long. The burrs are exceedingly numerous, one being borne practically in the axil of each leaf. They are densely clothed with cottony wool, and are armed with five slender, unequal spines, the longest spine on the older burrs being usually about one-third of an inch long. Each burr contains one or perhaps two seeds.

Mintweed is botanically *Salvia lanceolata,* and is a native of the United States and Mexico. It is a strong-smelling, much branched annual weed, the young parts clothed with short stiff hairs. The stems are angular. The leaves are densely clothed on the under surface with short stiff hairs, and are mostly 1 to 2 inches long and about a-quarter inch wide. The flowers are blue, and are either opposite or borne in whorls of three or four in slender terminal spikes. The ovary in the centre of the flower is four-lobed, and when ripe develops into four pale straw-coloured nutlets or seeds.

Johnson Grass.

F.T. (Charters Towers)—

Johnson Grass is poisonous, and the roots, or rather the underground stolens, which are white and succulent, have been the cause of deaths of both cattle and pigs. Johnson Grass is distinguished by the possession of these long, white underground runners. Soudan Grass is similar to it, but is of a finer growth and of annual character.

Another grass with which both are confused is *Sorghum verticilliflorum.* This particular one is extremely poisonous, perhaps the worst of the three. It is a strong-growing grass, fairly common in some parts, of a perennial character, arising from fresh buds at the base every year. Johnson Grass and Soudan Grass, I may mention, are both Sorghums. The former is *Sorghum halipense,* the latter *Sorghum sudanense.* The best plan would be for you to send specimens of the plants supposed to have caused the trouble.

The Mulgas.

D.C. (Eulo)—

The common Mulga extends through Queensland, New South Wales, and South Australia right over to Western Australia. As is natural in a tree of such a wide range, it shows considerable variation. In Western Australia and South Australia a few trees other than the common Mulga (*Acacia aneura*) are called Mulga with some prefix, such as Desert Mulga, Irishman's Mulga, &c. In Queensland, however, all the Mulgas belong to the one species (*Acacia aneura*). It varies in stature and width of leaf, and there is a good deal of confusion about the fodder value of the different forms; in some localities the broad-leaved form being considered the better, and in others the narrow almost round-leaved varieties being considered the best.

Mr. C. J. McMaster, when chairman of the Western Lands Board, forwarded for publication to Mr. J. H. Maiden, then Government Botanist in New South Wales, a few notes on the different forms of the common Mulga in North-western New South Wales, and his remarks probably apply to South-western Queensland. He distinguished four different kinds—namely, the Umbrella Mulga, a narrow-leaved form growing on hard, stony ground, and generally considered excellent feed for stock; the broad-leaved Mulga, a form growing in the valleys between stony ridges; the Black Mulga, a form with leaves small, dark, and narrow; the Yellow Mulga, the common form on the red, sandy, typical Mulga soils, and generally regarded as the best of the Mulgas; it commonly has a somewhat yellowish tinge in the foliage.

Intermediate forms between these different kinds occur, and in some districts a large number of Mulgas are recognised, though they are not given distinctive names.

Plants from South Burnett Identified.

S.L. (Tingoora)—

(1) *Vittadinia australis*, a common weed of the family *Compositæ*. We have not heard a common named applied to it, and it is not known to possess any particular properties, useful or otherwise.

(2) *Euphorbia pilulifera*, Asthma Weed or Asthma Plant, a very common weed in Queensland. The dried leaves are made into tea and used fairly extensively to give relief in asthma; hence the local name. We think, however, that the effects of the plant wear off after a certain time, the system becoming more or less used to it.

(3) *Chenopodium carinatum*, a very common weed in Queensland. We have not heard a local name applied to it. It contains a prussic-acid-yielding glucoside, but we cannot say we have ever observed it to be eaten by stock to any extent, certainly not in sufficient quantities to cause trouble.

(4) *Solanum nigrum*, Garden Nightshade. The ripe berries are freely eaten by children, and are sometimes used for cooking without any ill-effects following. Occasionally trouble is experienced from the plant, and this is probably due to the berries being eaten in an unripe condition. They contain the poisonous principle Solanin, which tends to disappear as the berries ripen.

(5) *Stachys arvensis*, Stagger Wood, also called Wild Mint or Mintweed, but not to be confused with the Mintweed that has been given a good deal of prominence in the Press during the last couple of years. It causes "staggers" or "shivers" in working or travelling stock, but ordinary paddock stock eat the plant with impunity.

(6) *Gallinsoga parviflora*, Yellow Weed, and sometimes called Chick Weed, though this latter name more correctly belongs to another plant.

(7) *Euphorbia Drummondii*, Caustic Creeper, a very common weed in Queensland. On the whole, paddock stock, when they do eat the plant, seem to suffer little or no ill-effects from it. With travelling stock, however, much trouble has been reported. In New South Wales tests with the plant have on many occasions given a positive reaction for the presence of a prussic-acid glucoside, but repeated tests with Queensland specimens have always given negative results, and the symptoms described by experienced stock-owners in Queensland are certainly not those of prussic-acid poisoning. The head and neck of affected animals swell considerably. If the swelling is pierced an amber-coloured fluid exudes, and the life of the beast may be saved.

(8) *Oxalis corniculata*, Wood Sorrell.

(9) *Rumex Brownii*, Dock.

(10) No flowers, but we should say *Geranium dissectum*, Crow-foot; an excellent pasture plant, sometimes known as Wild Carrot, though this name more correctly belongs to a different herb. It is especially favoured by sheep.

Red Ash.

F.A.B. (Marmor)—

The specimen is the Red Ash (*Alphitonia excelsa*), a very common tree, widely distributed in Queensland and New South Wales. Stock, particularly horses, are very partial to it, and it is an excellent drought fodder. In addition to Red Ash, it is sometimes called Silver Leaf, Silver Wattle, White Ash, and other names, though, of course, it is not related to the true Wattles in any way, and belongs to a family of plants known as the *Rhamnaceæ*. Red Almond is the name adopted by the Forestry Department for the timber of this and some allied species. The leaves are somewhat saponaceous, and are commonly used by school children as a substitute for soap.

The Clove Tree.

W.G. (Cairns)—

We do not know of any Clove Tree in Australia, and you would have to import plants. The tree is rather difficult of propagation, and it is a few years before the first crop is borne. The present seat of the industry is at Zanzibar, which supplies about 90 per cent. of the world's requirements. It is possible you could obtain seeds or plants from some tropical nurseryman at Java, and if you write to the Director, Botanic Gardens, Buitenzorg, Java, Dutch East Indies, he may put you in touch with someone.

A Common BeachTree (*Ochrosia*).

E.C.D. (Townsville)—

The specimen is a species of *Ochrosia,* and we should say *Ochrosia elliptica,* a very common beach tree in parts of North Queensland and the islands of the Pacific. It is very common on some of the islands, such as Hayman Island, and is very noticeable on account of the great quantity of bright-red fruits it bears. So far as we know, these fruits are not edible, though we have no definite information on this point. The plant belongs to a poisonous family, the *Apocynaceæ,* and must therefore be looked on with suspicion. We have often noticed, however, that the fruits on the ground have been eaten to a limited extent by wild animals and birds. We do not know of a common name for the plant.

Red Flowering Gum.

L.G. (Toowoomba)—

We do not remember having seen the red-flowering Gum grafted on another stock. The plant is so readily raised from seed, and comes fairly true to type, that the practice of grafting plants is not resorted to. If you wish, however, to try your hand at grafting the red-flowering Gum on some of the Eucalypts about Toowoomba, the closest allies of the red-flowering Gum growing in your district are the Bloodwood, Spotted Gum, and Moreton Bay Ash. We should think trees about half an inch in diameter could be taken, and this month would probably be as good a time as any to do the work.

Flannel Weed.

A.J.E. (Brisbane)—

The specimen forwarded is the Flannel Weed, *Sida cordifolia,* a plant widely spread as a weed in most tropical and subtropical countries, including Central and North Queensland. It has been established in North Queensland for many years, particularly about some of the northern towns, such as Townsville and Cairns, and of late has spread more south, though in the more southern parts it does not seem to be the pest it is in the North. Arsenical sprays could be used in its eradication, but, of course, these are impracticable where stock are running, and in any case a certain amount of danger is always incurred when weeds are sprayed in stock country, even though reasonable caution may be used. Hand-pulling is rather expensive, but most of these *Sida* weeds, such as *Sida retusa* and the present species, can be kept down by several mowings. Scything would have to be done several times before the rootstock was exhausted. The plant possesses no harmful properties, not being poisonous to stock in any way.

Pimpernel.

G.R.I. (Gympie)—

The specimen bore neither flowers nor seeds, and in such cases it is difficult to name with certainty, but we should say it is the common Pimpernel (*Anagallis arvensis*). It is not a member of the Pea family, but from the name "Blue Pea" it is probably the blue flowered form. The plant is definitely poisonous, but on the whole is unpalatable to stock. Dr. Gilruth stated that the plant was responsible for the death of a large number of sheep in Victoria, apparently acting as a narcotic poison. The only case of definite poisoning by it that has come under our notice in Queensland was at Buderim Mountain, from where we received a quantity of seeds of the plant with the report that they were abundant in the paunch of a cow that had died from plant poisoning.

Trees for the West.

INQUIRER (Brisbane)—

Your specimen is *Codonocarpus cotinifolius,* the Bell Fruit, a native of Western Queensland and the neighbouring States. It occurs in the northern parts of South Australia, where it is generally known as Native Poplar. Regarding trees for the West, the following are some suggestions:—Bottle Trees, both narrow and broad leaved varieties; Currajong; Parkinsonia Tree; *Albizzia Lebbek,* commonly known in Western Queensland as Acacia; White Cedar; Pepper Tree; *Celtis sinensis,* commonly called Portuguese Elm; the Citron-scented Gum; Narrow-leaved Ironbark; *Bauhinia Hookeri*; Phytolacca or Bella Sombra Tree; *Acacia arabica;* Camphor Laurel; Pittosporum; and Algaroba Bean.

Water Gum. Tea Tree.

H.I.J. (Nundah)—

The Water Gum is *Tristania exiliflora*. This species is very common along water-courses in Eucalyptus country in North Queensland.

The Tea Tree is *Melaleuca linariifolia*. The principal constituents of the oil of this tree, according to Penrold, are terpinene, cymene, cineol (16-20 per cent), a terpineol, sesquiterpenes, &c. These constituents have been shown to have a high germicidal value. The oil from the species in Southern Queensland is being extracted in some cases.

Sunrise and Moonrise at Mackay and Warwick.

M.J.O'D. (Sarina)—

Your question as to the difference between the rising and setting times of the sun and moon at Mackay, as compared with Warwick, was referred to the Surveyor-General, Mr. J. P. Harvey, who advises as follows:—

SUN.

Warwick. 1934.	Rise. h. m.	Set. h. m.	Mackay. 1934.	Rise. h. m.	Set. h. m.
June 22	6 43	17 4	June 22	6 39	17 29
Dec. 23	4 53	18 49	Dec. 23	5 19	18 45

MOON.

Warwick. 1934.	Rise. h. m.		Set. h. m.	Mackay. 1934	Rise. h. m.		Set. h. m.
Jan. 26	15 41	Jan. 27	1 51	Jan. 26	15 33	Jan. 27	2 21
Feb. 10	0 44	Feb. 10	15 28	Feb. 10	1 14	Feb. 10	15 20

Note.—The table uses the 24-hour divisions—thus, 17h. 4m. equals 5.4 p.m.

The times of rising and setting of the sun are given at both solstices—that is when the sun is at its maximum northern and southern positions. Similarly, the moon is at its maximum northern and southern positions on 26th January and 10th February respectively. An examination of the table will show the range of differences between the two places.

Scours in Calves.

INQUIRER (Brisbane)—Mr. K. S. McIntosh, B.V.Sc., Animal Health Station, Yeerongpilly, advises: This case may be due to—

(1) The sudden change in diet from whole to skim milk. This process should be carried out gradually. The skim milk should be fresh and free from froth. Up to half a pint of lime water to each gallon of milk will assist digestion. The milk should be fed at blood heat.

(2) Bacteria or germs present in the bowel causing white scour, red scour, or blood scour. White scour usually affects animals up to ten days old, while blood scour generally attacks them when over fourteen days. Whichever form is present, it should be regarded as contagious, and healthy animals running in the same pen may pick up the disease from droppings, &c.

Infection may take place through the navel at or shortly after birth or be sucked from the dirty teats of the mother. Treatment is often not worth while, particularly in severe cases.

PREVENTIVE MEASURES.

(1) Discard old pens and yards and build new ones which will not receive drainage from the old ones. Only place new healthy calves in new pens.

(2) Isolate healthy from scouring calves.

(3) Scrub all feeding utensils with soda and scald well.

(4) Permit cows to calve in a clean dry paddock, and allow the calf to suck its mother as long as possible.

(5) Tie the navel as soon as possible after birth with a piece of tape dipped in tincture of iodine. Cut off the navel cord below the tape and swab stump with tincture of iodine.

(6) If calves are taken away from mother soon after birth feed on warm whole milk for at least two weeks. Feed little and often and change gradually on to skim milk. Keep all utensils scrupulously clean.

(7) Add half a pint of lime water and one teaspoonful of formalin to each gallon of milk fed. If calves show signs of constipation discontinue the formalin and, if necessary, replace it with castor oil.

Mat Grass.

W.F. (Traveston)—

The specimen of grass is Mat Grass or Carpet Grass (*Axonopus compressus*). Two forms of the Carpet Grass occur in Queensland, a broad-leaved form and a narrow-leaved form, and your specimen represents the latter. This is now generally regarded as the inferior of the two. Mat Grass has occasioned some concern on parts of the North Coast line on account of its invading Paspalum pastures, and requests have been received to have it declared a noxious weed. The Department has not recommended that such action be taken because, although Mat Grass is certainly a very objectionable grass when it comes into Paspalum pastures, it nevertheless has a certain value on second-class country. There are several quite large pastures of Mat Grass in coastal Queensland, and the enforcement of the Act, if the plant were declared a noxious weed, would be almost impossible. Where Mat Grass makes its appearance in a Paspalum or Rhodes Grass pasture it decreases very much the carrying capacity of the pasture, and its eradication should be attempted. The best way would be to plough the infested area and resow with Paspalum, Kikuyu, Giant Couch (*Brachiaria mutica*) or Rhodes, and so smother the Mat Grass. A pasture so treated would, of course, have to be given a spell from stock.

In answer to a correspondent, Mr. Cyril White has supplied the following notes:—

NOOGOORA BURR—

After the heavy spring and early summer rains there was a prolific growth of seedlings of the Noogoora Burr this season, and one or two cases of poisoning by the seedling plants were brought under the notice of the Department of Agriculture and Stock. It does not seem to be generally known that Noogoora Burr is poisonous when quite young and still bearing the seed leaves. The plant probably loses its toxicity, however, when a few weeks old.

The Noogoora Burr is a robust annual weed up to 6 feet or more high, the female flowers eventually forming hard, woody burrs which, when ripe, are about 1 inch long and densely covered with hooked spines. These burrs contain two seeds, one of which usually germinates one year, and the other the following. It is a native of North America, and is supposed to have been introduced into Queensland with cotton seed from that country about seventy years ago.

The genus *Xanthium* consists of twenty-five distinct species, and according to Dr. F. J. Widder, who has recently written a complete account of them, the Queensland plant is *Xanthium pungens.* In the United States and Canada the Noogoora Burr and its allies are known as Cockle Burrs. They are there recognised as being poisonous in their seedling stage, but United States authorities state that experimental work has shown that beneficial results follow the administration of oils and fats to affected animals. For this purpose linseed oil, bacon grease, or lard can be used.

The Entomological Branch of the Department of Agriculture and Stock, acting on behalf of the Council for Scientific and Industrial Research, has recently liberated in Queensland a number of colonies of the Noogoora Burr Seed Fly (*Euaresta aequalis*). This parasite has been introduced from Kansas, and its effect on the distribution of the pest is awaited with interest.

WILD MINT—

Wild Mint (*Salvia reflexa,* previously recorded as *Salvia lanceolata*) is somewhat on the increase, and has been recorded from a few fresh localities. For those who are unacquainted with this plant it might be mentioned that it is a strong-smelling, much-branched annual weed. The leaves are densely clothed on the under surface with short, stiff hairs, are mostly 1 or 2 inches long and about ¼ inch wide. The flowers are borne in spikes, are blue, and about ⅓ inch long. The ovary borne in the centre of the flower is four-lobed, and develops later on into four pale-straw coloured nutlets or seeds.

It is a native of the United States and Mexico. No definite cases of poisoning by it have come under the notice of the Department of Agriculture and Stock during the past season. Losses from it are mainly in travelling stock, ordinary paddock stock seeming to feed among the plant taking an occasional bite without any ill effects following.

GALVANISED BURR—

The Galvanised Burr (*Bassia Birchii*) has spread very much on stock routes and on closely settled country. It is the general opinion held by both pastoralists and officers of the Department of Agriculture and Stock that a good growth of grass will in one or two seasons choke out the Galvanised Burr, but during the past season this does not seem to have been borne out by facts, and the plant seems much on the increase.

Though most abundant in the West, it is commonly seen in more coastal localities, seeds having dropped from sheep trucks, and is now and again met with as a weed on coastal fruit farms where scrapings from sheep trucks are used as manure.

For those unacquainted with the plant, it might be mentioned that it is a spreading, intricately branched, somewhat woody weed about 2 to 3 feet high. The stems and leaves are clothed with a white cottony wool, more or less disappearing from the older parts. The leaves are small and mostly under ½ inch long. The burrs are exceedingly numerous, one being borne practically in every leaf axil. Each burr bears mostly one seed, and as they are borne in great abundance the plant is easily spread from one place to another.

WEIR VINE—

The Weir Vine has attracted some considerable attention during the past twelve months owing to the rapidity with which it is spreading in parts of the southern Maranoa. The Weir Vine is a creeping plant, the roots producing large underground Sweet Potato-like tubers. The leaves are fairly large, sometimes over 4 inches across. The plant is a member of the *Convolvulaceæ* or Morning Glory family, and the flowers are large, about 3 inches long; they mostly come out pinkish-red and turn to blue. The seed capsules are rather large, being about ¾ to 1 inch in diameter, and contain several blackish angular seeds.

The botanical name of the Weir Vine is *Ipomœa calobra*, the specific name *calobra* being given to it on account of its being known to the aborigines on the Barcoo as Calobra. It is most abundant in Queensland in the hard red soils of the southern Maranoa.

The importance of the plant lies in the fact that stock that take to it become affected in much the same way as those affected by Indigo or Darling Pea. They have a wild staring look in their eyes. Cattle will try to catch their tails, and in bad cases they go in the loins. Horses are affected in much the same way. They rear up, try to climb trees, &c., and sometimes so injure themselves that they have to be destroyed. Some stockowners think it is the pods that cause the damage and not the leaves only, but on this point we have no definite information.

The large underground tubers are quite harmless, and were used as food by the aborigines. Some white people who have used them say that when cooked they do not taste badly. They are evidently quite harmless raw, because bushmen often chew or suck the raw, rather juicy tubers to allay thirst.

A New Grass Genus.

E.H.B. (Miles)—

You may remember that when Mr. Hubbard was in Queensland you sent down specimens of a grass which was quite new to us and which did not agree with anything previously in our collections. It will interest you to know that Mr. Hubbard has now named this as a new genus of grasses under the name of *Homopholis*, and he has given the grass the name of *Homopholis Belsonii*. The specimens you collected at the head of Dogwood Creek, east of Gurulmundi, in November, 1930, are the only specimens we possess, but we expect to get a few more in from the Western Downs and Maranoa district before very long.

Woolly Finger Grass.

R.S.McK. (Mungallala)—

The Woolly Finger Grass (*Digitaria eriantha*) should grow quite well in your district. We think that it has a future in parts of the Maranoa and Western Darling Downs, particularly in sandy lands at present occupied by Spear grasses or short-lived summer species. If propagated by roots in the spring or early summer it should soon send out runners and establish itself, but stock, of course, would have to be kept off it for a few months until the grass became strong enough to stand feeding.

General Notes.

In Memoriam.

MRS. ALEXANDER ROBERT HENRY.

The many friends of Mr. Alec. Henry, the secretary of the Central Sugar Cane Prices Board, will regret to learn of the passing of his beloved wife, which sad event took place at her home at Clayfield, Brisbane, on Monday, 9th July. The late Mrs. Henry was in her usual good health on the morning of the day of her death, and after attending to her home duties, left for the railway station to fulfil an engagement in the city. While waiting for the train she was overtaken with a seizure and conveyed back to her home, where she gradually sank and passed away at midday. The deceased lady possessed a charming personality, and was associated with many charitable and social organisations. Her friendships encircled many people throughout the State who will mourn with her bereaved relatives in the loss of a splendid wife and mother. The funeral moved from her residence at Clayfield for the Nundah Cemetery on the following day, the long cortege consisting of representative men of the Department of Agriculture and Stock, including the Minister, the Hon. Frank W. Bulcock, the sugar industry, and the business life of Queensland. We extend our deepest sympathy to her sorrowing family in the tragic loss they have sustained.

Canary Seed Board.

The Canary Seed Board election resulted as follows:—

	Votes.
George Burton (Cambooya)	200
Garret Denis O'Neill (Allora)	199
Michael Coleman (Nobby)	149
Edwin Sylvester Maher (Allora)	90

Messrs. Burton and O'Neill are the present members of the Board, and will therefore be reappointed for a further term of one year as from the 1st June.

Trans-Border Stock Crossings.

Following an outbreak of ticks in New South Wales in close proximity to the Stanthorpe-Killarney area, an Order in Council has been issued placing certain restrictions on the introduction of stock at all crossing places between and including Wallangarra and east to Stanthorpe. This means that all cattle and horses entering the State must be provided with a certificate of health and freedom from ticks, and a certificate that they have been dipped or hand-dressed as prescribed within seven days before crossing. Also they must be found clean upon inspection at the crossing places, and again dipped or hand-dressed.

State Wheat Board.

A regulation has been approved under the Wheat Pool Acts, which will provide that the four representatives of wheatgrowers on the State Wheat Board appointed for the period from 1st September, 1933, to 31st August, 1934, may be appointed to be members of such Board for a further period not exceeding eight months, as the Minister shall think fit.

Staff Changes and Appointments.

The following have been appointed members of the Stallion Boards hereunder specified:—

East Moreton District Stallion Board.—Messrs. J. C. J. Maunder, B.V.Sc., Government Veterinary Surgeon (Chairman), W. Frood, and S. R. Watson.

Wide Bay District Stallion Board.—Messrs. A. F. S. Ohman, M.V.Sc., Government Veterinary Surgeon (Chairman), R. J. F. O'Bryen, and G. Elliot.

Burnett District Stallion Board.—Messrs. A. F. S. Ohman, M.V.Sc., Government Veterinary Surgeon (Chairman), R. J. F. O'Bryen, and G. Elliot.

Central Coast District Stallion Board.—Messrs. J. C. J. Maunder, B.V.Sc. (Chairman), W. C. Jeffery, and J. Sprott.

Northern Coast District Stallion Board.—Messrs. A. F. S. Ohman, M.V.Sc. (Chairman), M. F. Yore, and R. Tait.

Miss D. Bowder, Assistant Cane Tester at Inkerman Mill, has been transferred to the position of Cane Tester at Maryborough Mill in lieu of Miss D. Marles, resigned. The following Assistant Cane Testers have also been appointed:—Miss A. Smith (Cattle Creek Mill), Mr. A. R. Hughes (Inkerman), Mr. F. P. Mulligan (Invicta), Miss A. L. Dahl (Isis), Mr. E. J. Delaney (Kalamia), Miss P. Eadie (Qunaba).

Messrs. R. Lauder (Tully) and H. B. Randall (Facing Island, Gladstone) have been appointed Honorary Rangers under the Animals and Birds Acts.

Acting Sergeant C. P. Murray, Jundah, has been appointed also an Inspector under the Brands Acts.

Constable J. Geraghty, of Injune, has been appointed also an Acting Stock Inspector and Inspector of Brands.

The Officer in Charge of Police, Eton, has been appointed also an Acting Stock Inspector.

Messrs. A. Menkins, A. E. Bonnet, and V. B. Martin have been appointed Assistant Cane Testers at the Cattle Creek, Invicta, and Plan Creek Sugar Mills, in lieu of Miss A. Smith, Mr. F. P. Mulligan, and Miss E. A. Crees, who have resigned.

The Council of Agriculture.

An Order in Council has been issued in pursuance of the provisions of the Primary Producers' Organisation and Marketing Acts, declaring the number of members of the Council of Agriculture to be twenty-eight. A regulation has also been issued prescribing the members of Commodity Boards who shall be members of the Council. These include two members of the Butter Board, Messrs. J. McRobert (Maryborough) and W. J. Sloan (Malanda), and one member each of the remaining Commodity Boards, Messrs. H. T. Anderson (Biddeston), Cheese Board; J. Beck (Stanwell), Cotton Board; L. R. Crouch (Atherton), Atherton Tableland Maize Board; C. Brumm (Woongoolba), Arrowroot Board; C. F. Adermann (Kingaroy), Peanut Board; R. V. Woodrow (Woodford), Honey Board; H. Kessler (Cambooya), Barley Board; A. McLauchlan (Boonah), Egg Board; H. Niemeyer (Hatton Vale), Broom Millet Board; G. D. O'Neill (Allora), Canary Seed Board; D. Johnston (Malanda), Northern Pig Board; and G. A. Duffy (chairman of the Timber Advisory Committee), Plywood and Veneer Board. The Committee of Direction of Fruit Marketing, the Queensland Cane Growers' Council, and the Wheat Board are also included, and their representatives are: Messrs. W. Ranger (Brisbane), G. Johnson (Mirani, Mackay), and W. J. Brimblecombe (Pirrinuan). The Minister for Agriculture and Stock (Hon. F. W. Bulcock) is President of the Council, and the Director of Marketing (Mr. E. Graham) is a member by virtue of his office.

Removal of Citrus Plants from Elimbah District Prohibited.

Owing to an outbreak of Brown Spot disease of mandarins in the Elimbah district, a Proclamation has been issued under the Diseases in Plants Acts, prescribing such district to be a quarantine area and prohibiting the removal of any citrus plants therefrom.

Pineapple Levy Regulations.

A regulation has been issued under the Fruit Marketing Organisation Acts empowering the Committee of Direction of Fruit Marketing to make a levy on all pineapples marketed for the year ending 19th August, 1935. The levy is similar to that of last year, namely:—

(*a*) On all pineapples sold or consigned whether by rail, road, or boat, to fruit-canners, at the rate of 1d. per case.

(*b*) On all pineapples sold or consigned by rail to agents, or others, except to factories, at the rate of 1s. 4d. per ton, with a minimum of 1d.

(*c*) On all pineapples sold or consigned otherwise than by rail to any Queensland railway station to any agent, or firm, except to factories, at the rate of ½d. per case, with a minimum of 1d.

Where sold loose, the levy shall be ½d. (with a minimum of 1d.) for 24 smooth leaf pineapples or 42 rough or ripley pineapples, as being equal to a case of fresh pineapples.

Every company or person carrying pineapples for any market other than for railing from any station, shall furnish a monthly return to the C.O.D. regarding the fruit carried.

The levy on all fruit railed from any Queensland railway station (except Toowoomba, Townsville, Rockhampton, Roma Street, Woolloongabba, Brunswick Street, South Brisbane, or Central Stations) to any other Queensland railway station, and not consigned to factories, may be collected by the Commissioner for Railways to the extent of 1s. 4d. per ton, with a minimum of 1d.

Subject thereto, and except as provided, the levy in the first instance shall be collected on all pineapples sold or consigned by rail or otherwise to factories by the C.O.D. at the rate of 1d. per case; on all fruit delivered otherwise than by rail to any railway station to any agent or person except a factory, by such agent or person at the rate of ½d. per case, with a minimum of 1d.

The sums raised by the levy shall be expended by the C.O.D. in the interests of the pineapple-growers.

Proposed Co-operative Flour Mill.

In the course of a recent Press statement, the Minister for Agriculture and Stock, Mr. Frank W. Bulcock, said that it was gratifying to him to note that definite steps had been taken towards the formation of a co-operative flour-milling company, and that this company was about to be registered under the Companies Act. Originally an application was made for registration under the Primary Producers' Co-operative Associations Acts, but those Acts require that shareholders shall be direct suppliers to the mill. With our pool system in operation, every producer is a direct supplier to the Board, and therefore only the Board can supply to the mill. This difficulty was not visualised when the original legislation was passed, but, as the Acts stand at the present time, the wheat farmers interested in the establishment of a co-operative mill are definitely debarred from participation under the Co-operative Associations Acts. However, said Mr. Bulcock, it was his intention to make certain recommendations involving an alteration in those Acts, in order that pool boards may be regarded as suppliers within the terms of those Acts. He anticipated that amending legislation would receive the early attention of Parliament.

Appeal against Declaration of an Abandoned Orchard.

Regulations have been issued under the Diseases in Plants Acts which provide that, when an occupier or owner of a piece of land who has received notice from the Minister that under the powers conferred by the abovementioned Acts it is intended to declare his orchard or nursery an abandoned orchard or nursery desires to appeal against such decision, the appeal must be lodged within a period of twenty-one days from the date of the notice by the Minister. The appeal must be made in a special form, as prescribed, to the Clerk of Petty Sessions for the Petty Sessions District in which the land concerned is situated. A notice of intention to appeal, in a specified form, must also be forwarded to the Minister. The Clerk of Petty Sessions shall fix a time and place for the hearing of the appeal, and shall notify the parties concerned.

Dairy Cattle Improvement Act, End of Controversy.

At a special conference of Dairy Companies of Queensland, convened by the Queensland Butter Board, the payment of the levy under the above Act was the principal matter discussed. Representatives of practically all the companies in Queensland were present, and a resolution was carried—Maryborough being the only dissentient—that the companies would pay the levies imposed under the Act.

The Maryborough company intimated acceptance of the resolution. This means that Maryborough will now make its contributions to the Butter Board.

Animal and Bird Sanctuaries Proclaimed.

The following sanctuaries have been declared in pursuance of the provisions of the Animals and Birds Acts:—Pig and Sheep Islands, in Noosa River; Mount Woorooolin Park Reserve, Kingaroy; the property adjacent to the Town Common, Townsville, known as the Old Cluden Racecourse; and "The Plains," Boondooma, via Preston. It will, in future, be an offence to take or kill any animal or bird on the abovementioned properties.

The Tobacco Industry Portection Act in Force.

A Proclamation has been issued bringing into operation, as from 12th July, the Tobacco Industry Protection Act, a measure passed last session. Orders in Council have also been issued constituting districts and declaring certain diseases, pests, and fungi under the Act. Regulations to give effect to the provisions of the Act have been promulgated.

A number of Officers of the Department of Agriculture and Stock, including Field Officers of the Agricultural Branch, Inspectors under the Diseases in Plants Acts, and Officers of the Entomological Branch, have been appointed also Inspectors under the Tobacco Industry Protection Act.

An Order in Council under the Diseases in Plants Acts, relative to the eradication of tobacco plants, has been rescinded, as the Tobacco Act covers the destruction of old plants.

The Plywood and Veneer Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Plywood and Veneer Board by inserting a provision which will empower the Minister, upon the recommendation of the Board, to direct, by public notification in the *Gazette*, that no person shall deliver any plywood and/or veneer to the Board before the date mentioned in such notification. The following consequences shall ensue until the date mentioned:—Growers shall deliver to the Board each month, or at times decided by the Board, a return showing the total quantities of plywood and/or veneer manufactured during the preceding month, and the names and addresses of those to whom the commodities were delivered. Agents for the sale of the commodities shall deliver to the Board, when so required by the Board, returns showing the quantities of plywood and/or veneer sold by them during the preceding month, or term fixed by the Board, and the prices realised therefor. The Minister may appoint any person to inspect any books and accounts of growers or agents.

Banana Board.

An Order in Council has been issued under the Banana Industry Protection Act, providing for a levy on banana growers to be used for the maintenance of the Banana Industry Protection Board. The levy is the same as that imposed during the last few years, and is at the rate of 1½d. per case containing 1¼ bushels or less for all bananas marketed in the case, and 2d. in the £ or part thereof on the proceeds of sales of all bananas marketed in the bunch. The levy will be effective for a period of twelve months as from 1st August next.

Regulations under the Dairy Products Stabilisation Act.

Regulations have been issued under "*The Dairy Products Stabilisation Act of 1933.*" These provide for the appointment of officers of the Dairy Products Stabilisation Board; the conduct of business at meetings of the Board; resolutions; vacancies on the Board; committees; and consultations with other Boards. Further, it will be necessary for manufacturers to keep registers of dairy products manufactured or processed. Provision is made for penalties and for prosecutions.

Orchard Notes for September.

THE COASTAL DISTRICTS.

SEPTEMBER is a busy month for the fruitgrowers in the coastal districts of this State, as the returns to be obtained from the orchards, vineyards, and plantations depend very largely on the trees, vines, and other fruits getting a good start now.

In the case of citrus orchards—especially in the southern half of the State—it is certainly the most important month in the year, as the crop of fruit to be harvested during the following autumn and winter depends not only on the trees blossoming well but, what is of much more importance, that the blossoms mature properly and set a good crop of fruit.

This can only be brought about by keeping the trees healthy and in vigorous growth, as, if the trees are not in this condition, they do not possess the necessary strength to set their fruit, even though they may blossom profusely. The maintenance of the trees in a state of vigorous growth demands—first, that there is an adequate supply of moisture in the soil for the requirements of the trees; and, secondly, that there is an adequate supply of the essential plant-foods available in the soil.

With respect to the supply of moisture in the soil, this can only be secured by systematic cultivation, except in seasons of good rainfall or where there is a supply of water for irrigation. As a rule, September is a more or less dry month, and when it is dry there is little chance of securing a good crop of fruit from a neglected orchard.

If the advice that was given in the Notes for August regarding the conservation of moisture in the soil has been carried out, all that is necessary is to keep the soil stirred frequently, so as to prevent the loss of moisture by surface evaporation. If the advice has been ignored, then no time should be lost, but the soil should be brought into a state of good tilth as quickly as possible.

Where there is a supply of water available for irrigation, the trees should receive a thorough soaking if they require it. Don't wait till the trees show signs of distress, but see that they are supplied with an adequate supply of moisture during the flowering and setting periods.

It is probable that one of the chief causes why navel oranges are frequently shy bearers in the coastal districts is that the trees, though they produce a heavy crop of blossoms, are unable to set their fruit, owing to a lack of sufficient moisture in the soil at that time, as during seasons when there is a good rainfall and the trees are in vigorous growth, or where they are grown by irrigation, as a rule they bear much better crops. The importance of maintaining a good supply of moisture in the soil is thus recognised in the case of this particular variety of citrus fruit.

When the trees show the want of sufficient plant-food—a condition that is easily known by the colour of the foliage and their weakly growth—the orchard should be manured with a quick-acting, complete manure, such as a mixture of superphosphate, sulphate of ammonia, and sulphate of potash, the plant-foods which are soluble in the water contained in the soil and are thus readily taken up by the feeding roots.

Although the foregoing has been written mainly in respect of citrus orchards, it applies equally well to those in which other fruit trees are grown. Where the land has been prepared for bananas, planting should take place during the month. If the plantation is to be made on old land, then the soil should have been deeply ploughed and subsoiled and brought into a state of perfect tilth prior to planting. It should also receive a good dressing of a complete manure, so as to provide an ample supply of available plant-food. In the case of new land, which has, as a rule, been scrub that has been recently fallen and burnt off, the first operation is to dig the holes for the suckers at about 12 ft. apart each way. Good holes should be dug, and they should be deep enough to permit the top of the bulb or corm of the sucker to be 6 in. below the surface of the ground.

Care should be exercised in the selection of suckers, butts, or bits. Either of the two latter are preferable, and in the case of suckers which have broken into leaf, these should also be cut hard down to the butt. Before planting, all roots should be cut off closely and the surface pared or scraped, excepting over the buds or eyes which

are allowed for development. Where the butts are split into sections (up to four) according to the number and placements of eyes, these are planted with the eye or eyes facing downwards. In the case of butts, two to three eyes are left spaced around the butt, and surplus ones being removed, the top having previously been cut down to the corm and the centre scored out. Better growth is evidenced in each case, and as no cut surface is made available (each "plant" being covered by a few inches of soil immediately) beetle-borer infestation is not shown.

In old banana plantations keep the ground well worked and free from weeds and remove all superfluous suckers; also all bases of plants which have fruited.

When necessary, manure—using a complete fertilizer rich in potash, nitrogen, and phosphoric acid, such as a mixture of meatworks manure and sulphate of potash —two of the former to one of the latter.

Pineapples can also be planted now. The ground should be thoroughly prepared —viz., brought into a state of perfect tilth to a depth of at least 1 ft.—more if possible—not scratched, as frequently happens; and when the soil requires feeding, it should be manured with a complete manure; which should, however, contain no superphosphate, bonedust or Nauru phosphate being preferable.

Old plantations should be kept in a good state of tilth and be manured with a complete fertilizer in which the phosphoric acid is in the form of bonedust, basic phosphate, or finely ground phosphatic rock, but on no account as superphosphate.

The pruning of custard apples should be carried out during the month, leaving the work, however, as late in the season as possible, as it is not advisable to encourage an early growth, which often means a production of infertile flowers. If the weather conditions are favourable passion vines can also be pruned now, as if cut back hard they will make new growth that will bear an autumn crop of fruit instead of one ripening during the summer.

Grape vines will require careful attention from the time the buds start, and they should be regularly and systematically sprayed with Bordeaux mixture from then till the time the fruit is ready to colour, in order to prevent loss by downy mildew or anthracnose. Sulphuring may be required against powdery mildew.

Where leaf-eating beetles, caterpillars, or other insects are present, the trees or plants on which they are feeding should be sprayed with arsenate of lead. All fruit-fly infested fruit must be gathered and destroyed and on no account be allowed to lie about on the ground, as, if the fly is allowed to breed unchecked at this time of the year, there is very little chance of keeping it in check later in the season.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

WHERE not already completed, the winter spraying with lime-sulphur should be finished as early in the month as possible. Black aphis should be fought wherever it makes its appearance by spraying with a tobacco wash, such as black-leaf forty, as if these very destructive insects are kept well in hand the young growth of flowers, leaves, wood, and fruit will have a chance to develop.

The working over of undesirable varieties of fruit trees can be continued. The pruning of grape vines should be done during the month, delaying the work as long as it is safe to do so, as the later the vines are pruned the less chance there is of their young growth being killed by late frosts. Keep the orchards well worked and free from weeds of all kinds, as the latter not only deplete the soil of moisture but also act as a harbour for many serious pests, such as the Rutherglen bug.

New vineyards can be set out, and, in order to destroy any fungus spores that may be attached to the cuttings, it is a good plan to dip them in Bordeaux mixture before planting. The land for vines should be well and deeply worked, and the cutting should be planted with one eye only out of the ground and one eye at or near the surface of the ground.

In the warmer parts, which are suitable for the growth of citrus fruits, the land must be kept well cultivated, and if the trees need irrigating they should be given a good soaking, to be followed by cultivation as soon as the land will carry a horse without packing.

In these parts fruit fly should be systematically fought, as it will probably make its appearance in late citrus fruits and loquats; and if this crop of flies is destroyed, there will be every chance of the early crops of plums, peaches, and apricots escaping without much loss.

Farm Notes for September.

WITH the advent of spring, cultivating implements play an important part in farming operations.

The increased warmth of soil and atmosphere is conducive to the growth of weeds of all kinds, particularly on those soils that have only received an indifferent preparation.

Potatoes planted during last month will have made their appearance above the soil, and where doubt exists as to their freedom from blight they should be sprayed with either Burgundy or Bordeaux mixture as soon as the young leaves are clear of the soil surface.

Land which has received careful initial cultivation and has a sufficiency of sub-surface moisture to permit of a satisfactory germination of seeds may be sown with maize, millets, panicum, sorghum, melons, pumpkins, cowpeas, broom millets, and crops of a like nature, provided, of course that the areas sown are not usually subjected to late frosts.

Rhodes grass may be sown now over well-prepared surfaces of recently cleared forest lands or where early scrub burns have been obtained, and the seed is sown subsequent to showers. More rapid growths, however, are usually obtainable on areas dealt with, say, a month later.

In connection with the sowing of Rhodes grass, farmers are reminded that they have the Pure Seeds Act for their protection, and in Rhodes grass, perhaps more than any other grass, it is necessary that seed of good germination only should be sown. A sample forwarded to the Department of Agriculture will elicit the information free of cost as to whether it is worth sowing or not.

Where the conditions of rainfall are suited to its growth, paspalum may be sown this month.

The spring maize crop, always a risky one, requires to be sown on land which has received good initial cultivation and has reserves of soil moisture. Check-row seeding in this crop is to be recommended, permitting as it does right-angled and diagonal cultivation by horse implements, minimising the amount of weed growth, and at the same time obtaining a soil mulch that will, with the aid of light showers, assist to tide the plant over its critical period of "tasselling."

Although cotton may be sown this month, it usually stands a better chance if deferred until October. The harvesting of cotton during the normal rainy season is, if possible, to be avoided.

The sowing of intermediate crops prior to the preparation of land for lucerne sowing should be carried out in order that early and thorough cultivation can take place prior to the autumn sowing.

The following subsidiary crops may be sown during the month:—Peanuts, sweet potatoes, arrowroot, cow cane, and in those districts suited to their production yams and ginger. Plant out coffee.

If you like this issue of the Journal, kindly bring it under the notice of a neighbour who is not already a subscriber. To the man on the land it is free. All that he is asked to do is to complete the Order Form on another page and send it to the Under Secretary, Department of Agriculture and Stock, together with a shilling postal note, or its value in postage stamps, to cover postage for twelve months.

Rural Topics.

Care of Breeding Sows.

To obviate loss of condition owing to excitement and fever during "oestrum" or the period sow pigs are "on heat" during the stages when mature sows are being prepared for the bacon factory, it is suggested that the sows be mated to the boar about one month before date when it is desired to market them. This procedure is described in some text-books as "settling the sow," which really means encouraging her to "top up" more readily and be ready for slaughter ahead of the date she would be ready if the period of oestrum interfered with her development. However, there is always a risk associated with this, for it may so happen, owing to bad weather, bad roads. or other happenings, that it may not be convenient to market the sows when one month in pig only. If they are advanced in pregnancy, and are definitely showing as in pig, there may be an objection on the part of the buyer to purchase, and in the end the in-pig sow may realise less and prove less profitable than the sow not in pig which has taken a week or two longer to reach the marketing stage. Young sows should not, of course, be mated, as in this case it is both unwise and unnecessary.

There is an old belief that the sow is more likely to prove in pig—i.e., to hold to the service of the boar if she is mated late on the second or early in the third day of the period of oestrum. This period of being "on heat" lasts for three days, and recurs every twenty-one days until the sow becomes pregnant. It is often difficult to detect signs of oestrum on the first day of its occurrence, but if at all possible it is advisable to mate again on the second or third day even if the sow is first mated on the first day of the period. It is preferable also to mate about three days after weaning of the litter at eight weeks. Actually the sow will come in season three days after farrowing, and every three weeks after that, but, as stated, mating should be deferred till weaning takes place if the sow is normal and has suckled a good litter. It is not advisable to defer mating any longer unless there are special reasons for so doing.

When the sow is coming in season—she invariably becomes excited—there is a distinct restlessness and a tendency to jump on the back of other sows. A sow may even become a fence-breaker, and may wander away a considerable distance looking for a mate, or she may become very stubborn and refuse to move if approached. It pays to exercise considerable care and to be very patient with the animals at that time. In-pig sows should not be permitted to graze together with those suckling litters or that are not in pig, as accidents may happen. The sows may fight or interfere with one another, or the boar may knock them about. He should not be allowed to run with them except on special occasions, and even then care should be taken to see that he does not injure the sows or young pigs or that the sows do not injure him, for they sometimes fight and injure one another.

When sucking pigs are four weeks old (some will commence earlier) they should be encouraged to feed apart from the sow, and for this purpose should be provided with a trough in a separate enclosure. In fact, they will be all the better for having good grazing or succulent green food in addition to the sows's milk. They also like charcoal, and love to lick a block of rock salt. These latter supply minerals which are very necessary in the development of their bony and muscular systems. As the strongest pigs of the litter are usually those which have regular access to the teats to the front of the sow's udder (the teats nearest the forequarter), it may be an advantage to wean them earlier than the smaller ones in the litter; hence if they are able to feed on their own as separate from the sow it will be all the better for them and will enable the breeder to "even up the litter" and give the smaller ones a better chance.

The practice of spaying sows—that is, of removing their ovaries (part of their breeding organs) for a similar purpose to that in view in castrating male pigs—is not advised under conditions such as those ruling in the marketing of pigs in this country. Sow pigs do not usually come in season to any extent before the sow is six months of age, and if she is being prepared for pork or bacon she should be marketed or be ready for market before six months old. Similarly it does not pay to spay older sows, for the operation is not only a difficult one but a risky one, and it takes the sow some time to recover and get back to normal. The spaying of sows is not practised at all in Australia, although castration of the male pigs is a regular practice on every pig farm.—E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

Heredity and Environment.

At the Carrick Agricultural Discussion Society (Scotland) recently, a lecture was delivered by Mr. A. D. Buchanan Smith, Institute of Animal Genetics, University of Edinburgh, on "Heredity and Environment."

Mr. Buchanan Smith said what an animal is or what it does is the outcome of two forces acting upon each other—heredity and environment. The force of heredity provides an animal with certain qualities. As to whether these qualities are to be developed to their utmost depends upon environment. Environment can, indeed, completely mask the existence of certain hereditary qualities. Practically every character in plants, animals, and man is to a greater or less extent conditioned by heredity. Some characters are practically entirely due to heredity, with environment playing little or no part in their expression. An instance of this may be found in coat colour. The mode of the inheritance of coat colour in cattle affords an excellent example of some of the ways in which heredity works.

If we mate a black Aberdeen Angus to a red Shorthorn the progeny are all black in colour, taking after the Aberdeen Angus parent. If we mate two of these crossbreds together we find that, while the majority of the calves from these crossbreds are black, about one-quarter of them are red. In the same way, while the first cross calves from Aberdeen Angus/Shorthorn parents are polled, the second cross consists largely of polled animals, but abo— one in four are horned. If we were to raise an infinitely large population of the second cross animals, we would find that the proportion that appeared either red or horned would be exactly one in four. When we are working with smaller numbers the proportion may be slightly different. It is like tossing a penny. If you toss a penny a thousand times, you will get very nearly 500 heads and 500 tails. If, however, you toss it only a small number of times you may easily chance to get quite a big proportion of heads and small number of tails. The point to be emphasised is that the machinery of heredity works in a precise and mathematical manner. Where we know enough about the mode of inheritance in a character, we can predict the odds concerning the appearance of that character in the progeny.

Another Type of Inheritance.—An example of another type of inheritance can be found in the case of mating a White Shorthorn to a Black Galloway. The progeny of this cross will be all blue-grey. If you mate two of these first crosses together, then you will get calves that are black, red, blue-grey, roan. and white. Again, the colours appear in definite numerical proportions. The blue-greys will be the commonest, and next will come black and whites, followed by roan, while the reds will be comparatively rare. Incidentally, the majority of the whites will have black ears, but the odd one in sixteen will have red ears We can predict the odds with which any of these colours will turn up.

So much for a character conditioned practically entirely by heredity. Unfortunately for the genetic—or hereditary—analysis of the problem, the majority of the productive characters of our livestock are conditioned both by heredity and environment. Let us take milk yield in cattle as an example. Before we can start to study the inheritance of milk yield, or to assess the inherent milking capacity of individual cows, there are many points which we must take into consideration. There is the age of the cow, the age at first calving, the month of calving, the interval between calving and service, and the length of the dry period. There are, besides, a lot of other points relating to the nutrition of the animal and the type of husbandry under which it is kept. Obviously, we cannot expect as good records on a farm a thousand feet above sea level, where very few concentrates are fed to the cows. Nevertheless, the animals reared on such a farm may possess as good an inheritance for the production of milk as higher yielding cows reared on lush lowland pasture.

Milk Inheritance.—How is milk inherited? If I could answer that question precisely and accurately, I would be able to make my fortune. Unfortunately, owing, as I have said, to the interactions of environment upon hereditary characteristics, we cannot be definite about the mode of inheritance of milking capacity, and it is unlikely for many years that we shall achieve this happy position. Nevertheless, a considerable volume of work has been accomplished in all parts of the world, but particularly on the Continent of Europe and in North America, which has laid open certain quite definite facts, and also points to other knowledge which, if not quite so definite, may be fairly helpful.

I do not propose to give you the tribulation of understanding the highly complex methods by which many of these research workers have set about their investigations. It is my intention to give you the results of their work, and, in anything that I say concerning the hereditary character of milk yield I would be grateful if you

would remember that even the best of inheritance can be masked by a bad environment, and that this fact, doubtless, accounts for many of the anomalous results which breeders may experience.

In the first place, total yield of milk is inherited quite independently of total yield of butter fat. Further, the total yield of milk which a cow may give is far more affected by environmental causes than is the total yield of fat. This leads to the apparently anomalous fact that when a cow goes off her milk there is usually a tendency for the percentage of fat to rise. This does not mean that the cow is secreting any more fat. She is probably secreting about the same amount of fat, but since there is a lesser quantity of milk, the percentage of it in the milk is increased. This also accounts for the fact that when you try to select for high-yielding cows alone and ignore the question of butter fat, you obtain animals which, while they are high yielders, give only a small percentage of fat. Actually, the fat that they give, when measured in pounds, is probably about the same as their ancestors gave.

Mineral Content of Milk.—As regards the other constituents of the milk, many of these are almost entirely conditioned by heredity and very little influenced by nutrition. Take, for instance, the mineral content of milk. With the one exception of iodine, it does not apparently matter how much minerals you put into the feed, they have very little effect upon the amount secreted in the milk. You must not, however, imagine that for this reason you can ignore the feeding of minerals to dairy cows. On the contrary, it is most important that you should do so for their good health. Similarly, the size of the butter fat globule is largely conditioned by heredity, but what is more important, especially to Ayrshire breeders, is the hardness of the curd of the milk. The softer the curd may be the more easily is the milk digested by infants and invalids. All investigations which have been made clearly show that the hereditary influence is most potent in this respect.

The colour of milk is the product both of environment and heredity. No amount of feeding can make an Ayrshire give milk the colour of that secreted by one of the Channel Island breeds. Suitable feeding may make it approach that colour, but with similar feeding, a cow of the Channel Island breeds would give a much yellower fat. There is considerable variation in the amount of the vitamins secreted in milk, but this appears to be in no way conditioned by inheritance.

Some Interesting Results.—Coming now to the inheritance of the total yield of milk, as I said before, I will not weary you with all the details, but will endeavour to give you some of the results. The most useful way in which the subject might be approached is to deal with the selection of a dairy beast. First of all, let us consider the purchase of a mature cow. In this case you have the definite records of the cow to go upon. For a constructive breeder to buy a dairy cow without knowing how much milk she is capable of giving is, to put it mildly, rather foolish. Undoubtedly conformation is an indication of the amount of milk which she can give, but it is not a reliable indication. The chief value of conformation is to be able to judge the general health of the cow and ability to live a long life.

As regards heifers, there is nothing in their conformation which can be taken as an indication of their milk-producing capacity. We are thus thrown back upon the pedigree. Pedigree, in conjunction with milk records, is of undoubted value. The parents are of primary importance. Of the two grand dams in the pedigree particular emphasis should be laid upon the productive qualities of the dam of the sire. To have wonderful producing great-grandparents, while the grandparents and parents are only mediocre is of no value whatsoever.

Then comes the bull. Most people like to bet on a certainty. The only thing approaching a certainty in the selection of a dairy bull is a proven sire, where his inherited qualities may be judged by the productivity of his daughters. A bull who has left his daughters giving milk above the average, and also more milk than their dams is indeed a valuable animal. This is really the best guide to the purchase of heifers, that they should be sired by a bull that has proved himself good. In the selection of a young bull particular attention should be paid to the milk-production of his dam.

The great thing to remember about the inheritance of productive qualities in our livestock is that animals inherit potentialities and not completed structures.

Tanning of Hides—The Chrome Leather Process.

In an issue of these notes of some months ago, details as to how to make white hide were published. While white hide is a useful leather for general repair work around about the farm, the making of chrome-coloured leather from horse or cow hide is a subject of frequent inquiry. In supplying this information, the

Lecturer-in-charge of the Sydney Technical College Tanning School points out that the average farmer may find himself at a disadvantage in following out the process owing to lack of plant and experience. The procedure is as follows:—

1. Soak and wash the hide immediately after it is removed from the carcase. Time for this operation, four hours.

If the hide has been salted, wash well and leave in water overnight. The best tanners find it difficult to obtain good results with dry hides, and the farmer should therefore avoid them if possible. If not possible, then wash and soak them, using plenty of clean water until they are soft. The time taken varies from two to three days.

2. Remove the hair by soaking the drained hides in milk of lime, using 30 lb. of lime to 100 gallons of water.

Handle each day and leave until the hair can be removed—about six to seven days in summer. If sodium sulphide is available, use 1 to 3 lb. per 100 gallons of lime liquor; this addition will reduce the time for unhairing to four days. The hair is scraped off with a clear-edged, not not sharp, knife.

3. Remove all flesh and fat by scraping with a knife. Wash well with several lots of water during the twenty-four hours after removing the hair and flesh.

4. Soak 1 lb. of bran for each hide in 4 gallons of water for twenty-four hours, and then use it as an extra wash for the hides. This will take four hours.

5. Make up a chrome liquor as follows:—6 lb. sodium bichromate, 6 lb. sulphuric acid, 2 lb. sugar.

Dissolve the sodium bichromate in 2 gallons of water, then add the sulphuric acid, and finally the sugar in small proportions. When the sugar is added the solution will boil furiously. If all the sugar is added at once the solution will boil over, but it should be kept boiling by the slow addition of sugar until the colour of the liquor changes from yellow to blue.

The above chrome stock liquor will tan 150 lb. of wet hide from the bran wash.

6. Add the chrome liquor to the tanning bath in three lots at intervals of one day. Use enough water to cover the hides and allow 3 lb. of salt for every 10 gallons of water; then place the hides in the salt liquors before adding the first portion of the chrome liquor.

Allow six days for complete tannage, when a cut section should show that the blue chrome salt has pentrated into the centre of the hide.

7. Neutralise by washing in water and then in a bath containing 1½ lb. of sodium bicarbonate for 150 lb. of wet hide. Time taken—16 hours.

8. The hides are now washed and should receive a coat of neatsfoot oil on both sides.

9. Hang up the wet, oiled hides to dry.

10. When dry, stretch until soft. If dry hides are difficult to stretch, sprinkle with water and cover for two days, and again stretch and dry. The hides will remain soft if enough oil is used.

Handling is very important when hides are in the above solutions. To do this work properly, the hides should be removed from the solutions two or three times a day for about five minutes each time.

The hides are generally cut up the back, giving what is known as two sides. This is generally done before removing the hair.

Chrome leather should be suitable for repairs, &c., about a farm.—A. and P. Notes, N.S.W. Dept. Agric.

Why Cream is Second Grade.

Of the various causes of second-grade and "border-line" cream there is none so common as the contamination resulting from inefficient washing of dairy utensils. Contamination may result from—

- Failing to wash up twice daily.
- Washing up with cold water, either once or twice per day.
- Leaving the separator unwashed at night.
- Failing to use washing soda to remove grease from utensils.
- Using objectionable cloths or unclean brushes for washing up.
- Failing to scald thoroughly all utensils, brushes, &c., after washing.
- Failing to wash and scald cans on their return from the factory.
- Washing up utensils in polluted water—rain water is always preferable.

Hand-reared Pigs.

Mr. A. G. Stewart, proprietor of Strathmore Stud Piggery, Cedar Pocket, near Gympie, recently had the misfortune of having his Large White sow contract mammitis when her litter was born. Mrs. Stewart took an interest in the young pigs, and her experience in rearing the litter should be of interest to pig-raisers.

On the day following the birth of the litter of twelve pigs the sow was found to have completely lost her milk flow, and through her sickness the sow had killed two of the litter. When the remaining ten pigs were two and a-half days old and almost dead from starvation they were taken in hand and fed from a dish a mixture of half whole cow's milk and half water every two hours daily and once through the night. In the meantime Mrs. Stewart sought advice on the feeding, and then altered the diet to half separated milk and half whole milk, with sugar to sweeten. This was when the pigs were four days old.

During the third week the pigs were put on to one and a-half-hourly feeds during the day and one during the night. This was continued until the sixth week, when they were reduced to six feeds daily.

The food was kept half whole milk and half separated milk till the fourth week, when the proportion of separated milk was increased, and by the eighth week they were getting two parts separated milk and one part whole. During the sixth week whole maize grain was given in a hopper, and the pigs made good use of it.

The pigs were allowed to run on grass most of the time, and when they were deprived of this during the seventh week they got diarrhœa and lost their appetites. However, this was remedied by giving access to the grass run and a dose of castor oil to each pig on two consecutive days.

End of 1st week..	10 pigs	weighed 42 lb.	—Average weight,	4.2 lb.
End of 2nd week..	10 pigs	weighed 80 lb.	—Average weight,	8.0 lb.
End of 3rd week..	10 pigs	weighed 142 lb.	—Average weight,	14.2 lb.
End of 4th week..	10 pigs	weighed 200 lb.	—Average weight,	20.0 lb.
End of 5th week..	*9 pigs	weighed 240 lb.	—Average weight,	26.6 lb.
End of 6th week..	9 pigs	weighed 333 lb.	—Average weight,	37.0 lb.
End of 7th week..	9 pigs	weighed 396 lb.	—Average weight,	44.0 lb.
End of 8th week..	9 pigs	weighed 459 lb.	—Average weight,	51.0 lb.

* One pig died from sorghum poisoning.

The rearing of this litter of pigs is considered a very satisfactory achievement, as very few litters reared by the sow have an average weight of 40 lb. at eight weeks old.—E. J. Shelton, Senior Instructor in Pig Raising.

Hints on Soldering.

The materials necessary for soldering are one or two soldering irons, some sticks of solder, a bottle of muriatic acid (spirits of salts), and a small block of sal ammoniac. A handy container for the fire in which to heat the irons can be made out of an empty benzine tin or oil drum by cutting out the top, punching a few holes in the bottom, and cutting a hole in the side within an inch or so of the bottom, so that the heads of the irons can be passed through into the fire.

To prepare to solder, pour into a bowl (glass or ware—not tin or galvanised-iron) a quantity of the spirits and add a few pieces of zinc to "kill" the liquid. The soldering iron is first heated to a dull red heat, a fair portion of the point is filed clean, and this portion (while the iron is still hot) is rubbed with the sal ammoniac. The clean point is then tinned—that is, coated with solder—and this is of great importance if good work is to be performed later. To tin the iron, run a little solder on to a piece of clean tin, alternately turning its point in the melted solder and dipping it in the killed spirits.

Before using the soldering iron, clean the joint to be soldered, and with the aid of a brush put on a little of the killed spirits. The iron should be hot enough to make the solder run freely, but do not let it get red-hot. Withdraw it from the fire, brush the point with a piece of bagging, and dip it in the prepared spirits; then place the point of the iron on the joint to be soldered and move it slowly along, supplying solder as required by placing the end of the solder stick against the iron near the point. When soldering a loose patch, it will be found convenient to run a drop of solder on to the joint first, then hold the patch firm with the aid of the solder stick while the iron is operated to make the patch firm. The edges of any joints to be soldered should be fitted neatly and closely together, and the solder should run freely and adhere almost as if it were part of the tin.

Scours in Calves—Often Due to Parasitic Worms.

The occurrence of sickness and death among calves accompanied by loss of condition, scouring, and the development of "bottling" under the jaw, should lead to the suspicion that the stock are infested with parasitic worms, and a post-mortem examination of a very sick calf should be made to confirm the diagnosis. Some of the larger worms, such as the wire worm of the stomach, are readily seen, but the smaller parasites are difficult to demonstrate in an examination made in the field. Sometimes, by smearing a little of the stomach content, or the content of the first few feet of the small bowel, on a piece of clean glass or on the hand, the tiny worms will be discovered, but even when the worms are present the owner may not recognise them as parasites. In the case of doubt, skilled assistance should be sought.

Treatment and Prevention.—All the animals in the infested herd should be treated with a reliable remedy, after starving for twenty-four hours. A number of preparations will give good results, but the bluestone and mustard drench is cheap and very satisfactory. This is made up as follows:—

Bluestone crystals (copper sulphate)—8 oz.
Mustard—8 oz.
Water—3 gallons.

The bluestone should be dissolved in the water in an enamel or wooden receptacle. (Do not use iron buckets or kerosene tins.) The mustard is mixed to a smooth paste and then stirred into the bluestone solution. The mixture must be kept stirred, since the mustard will tend to sink to the bottom. The doses are as follows:—

Calf aged 4 months—3 oz.
Calf aged 6 months—4 oz.
Calf aged 9 months—6 oz.
Calf aged 12 months—8 oz.

Necessity for Repeated Treatment.—One treatment will produce some good effect, but it will be necessary to repeat the dosing in a fortnight, and again in a month, to obtain the best results. Where the infestation is heavy, and the stock are constantly reinfesting themselves from the eggs scattered over the pastures, drenching at regular intervals right through the year may be necessary.

If stock have become very low in condition, many may eventually die in spite of the treatment. This is because, although most of the worms have been killed by the medicament, the animals have lost so much vitality that their bodies are unable to build up and restore the tissues damaged as a result of the invasion by the worms. Hence when a diagnosis of worm infestation has been made, it is essential that treatment should be carried out as early as possible.

General Management.—A week after the cattle have been drenched they should, if possible, be removed to other paddocks, so that they will not be as likely to re-infest themselves. The infested paddocks used by the calves might be grazed by adult cattle, these not being so susceptible to the attack of worms. Most of the parasites which infest stock require moisture for their development on the pastures. Hence, low-lying areas which are constantly damp, swampy patches and soakages, are dangerous in that they provide conditions suitable to the hatching of the eggs and the later development of the embryo worms. In districts where worm infestation occurs the young stock should be grazed as far as possible on well-drained paddocks.

Frequently the ill-effects of worm infestation is most marked in the winter months, when the pasturage is known to be innutritious, and the calves should then be given a daily ration to make up for this lack of nutriment.—A. and P. Notes, N.S.W. Dept. Agric.

Points for Pig Raisers.

Spring pigs are those born during the spring and early summer months of the year. They invariably do well and have a better opportunity with more favourable food supply and better weather than those often spoken of as autumn pigs, which are born ahead of the cooler months of the year when food supplies are on the down grade and lower temperatures prevail. This does not infer that pigs do not develop satisfactorily during cold weather, for some of the best pigs in the world are those produced under harsh conditions in cold countries like Denmark, Sweden, Poland, Lithuania, and other European provinces.

Sunshine, fresh air, and plenty of nutritious foods are much to be desired in the breeding and feeding of stock for profit.

Overseas publications use the term "gilt" and "yelt" quite a lot in discussing pigs. These terms mean the same and apply to the female pig dating from weaning up till the time she produces her first litter. After that the gilt or yelt become fully fledged matrons in the herd and are known as brood sows, breeders, or as sows. The term "hog" invariably applies in this country to the entire male pig used for breeding purposes. The castrated male is known as a "barrow" pig. In America and other countries the term "hog" is used to describe all pigs irrespective of sex. The term "swine" is synonomous with pig—in fact, it is desirable to eliminate the term swine altogether and to use pig in discussing this class of stock and pig industry affairs associated with breeding, feeding, marketing, &c.

In-breeding, or the mating of animals which are too closely related is not advised in the breeding of pigs, as it invariably predisposes to weakness, barrenness, or sterility, and makes the animals more susceptible to diseases like tuberculosis, pneumonia, rickets, &c.

Line-breeding is a system of breeding practised for a special purpose and is a scientific business that should not be attempted by the inexperienced farmer. It is better to use males and females entirely unrelated than to run the risks associated with in-and-in-breeding or neglected breeding generally.

Pigs should not be weaned before they are eight weeks old—i.e., unless the sow suckling them is unable to do her job properly and has an insufficient supply of milk. It is preferable to allow the pigs to suckle the sow till nine or ten weeks of age than to wean before eight weeks, and the males that are to be castrated should be operated on between the age of five and six weeks. This operation should not be deferred till after weaning, as it becomes more risky and more difficult to perform as the animal develops and there is greater loss of time in recovery to normal health again.

When selecting a sow for breeding purposes be careful to make close inspection and see that the selected animal has no fewer than twelve teats. The sow with ten teats might be just as good a breeder or she might not, but it is better to be on the safe side and make twelve to fourteen teats a requirement in selection. In fact, if sows with sixteen teats are available, select them also, provided they are otherwise suitable, for the more young pigs a sow can suckle and rear to weaning age the better it is for the farmer, and unless the sow has the teats she cannot suckle her pigs. The sucking pig usually keeps to the same teat, and if the number of pigs is in excess of the number of good teats the balance of the suckers should be transferred to another sow or be bottle-fed or be destroyed, as it is useless expecting good results if the pigs are unable to suckle together without undue fighting or robbing. Small weakly "runts" rarely pay for keeping, and they often spoil a good litter and irritate a good sow, causing more harm than they are worth.—E. J. SHELTON, Senior Instructor in Pig Raising.

A Point in Horse Training.

In farm or road work the fast, even walking horse covers more miles in a day than one of erratic gait. It is not only a pleasure to sit behind a fast walker but saves time. In these days of high costs in every direction, the fast walker, by doing more work in a given time and costing no more to feed or drive is the more profitable animal to keep. The conformation of many horses is such that all the teaching and patience in the world cannot make them walk fast. Nevertheless the walking pace of every horse can be fully developed by careful training.

The treatment the young horse receives when being broken in often spoils the paces. It takes more time and patience to develop a good walking pace than many people are prepared to devote to it. The conformation of some animals is such that they require little teaching. The great fault is that so many men when breaking in a horse urge it too much in the early stages and expect it to go at a regular level pace too soon, with the result that its full measure of pace is never attained.

Too much attention cannot be given to training the young horse to walk well, for it is the foundation of its usefulness. How often has many a splendid goer disappointed his owner the first time he got into heavy pulling by virtually jibbing because he had never been taught to walk in a vehicle. The farm horse's work is done at a walking pace.

Apart from training much can be done towards the improvement by breeding only from mares that walk naturally and putting them to stallions of the right conformation that also walk freely.

Buying Better Boars.

That Queensland farmers have fully appreciated the advantages offered under the Pig Improvement (Better Boar Subsidy) Scheme is evidenced by the success that has attended the scheme initiated towards the end of last year by the Hon. the Minister for Agriculture and Stock (Mr. F. W. Bulcock), under which, on approved boar purchases, a 50 per cent. subsidy refund has been paid to purchasers of Large White and Middle White boars four months old and over, provided the maximum subsidy did not amount to more than £5 5s. The scheme is still in operation, but all future purchases will have to be arranged through the Rural Industries Board of the Agricultural Bank on a basis of the loan of 50 per cent. of the purchase price, repayable over two years.

Under the new conditions Berkshire and Tamworth boars will be included in the scheme as well as Large and Middle Whites, the age of approved boars being between four months and two years.

Full particulars of this scheme may be now obtained, and pig raisers are urged to act immediately if they desire to benefit under this system of purchase. It is of interest to notice that under the subsidy refund scheme Large White and Middle White boars have been distributed over a wide area of the State, including the following districts:—

WESTERN.—Dalby, Komine, Walloon, Square Top, Surat, Warwick, Aubigny, Cushnie, Pinelands, Drillham, Yamsion, South Canning Downs, Miles, Jondaryan, Kiamba, Mitchell, Kupunn, Moore.

MORETON.—Ipswich, Rosevale, Gold Creek, Marburg, Bundamba, Pine Mountain, Minden, Purga, Calvert, Biarra, Fernvale.

SOUTH BURNETT.—Tingoora, Murgon, Wondai, Cinnibar, Goomeri, Nanango, Cushnie, Wooroolin, Maleny, Kiamba, Mundubbera, Tableland, Brigooda, Boonenne, Marumbar, Gueena.

UPPER BURNETT.—Abercorn, Berajondo, Gayndah, Cannindah, Riverleigh, Biloela, Littlemore, Thangool, Kalaldo.

NORTH COAST.—Bauple, Howard, Builyan, Eerwah Vale, Widgie, Palmwoods, Maleny, Imbi, Mapleton, Kilcoy, Samsonvale, North Arm, Eumundi, Gunalda, Rockhampton, Garden Island, Mount Kilcoy, Mooloolah, Kin Kin, Redcliffe, Lagoon Pocket, Cooroy, Caboolture, Peachester, Zillmere.

SOUTH COAST.—Rathdowney, Ormeau, Currumbin, Sprinbrook, West Burleigh, Beenleigh, Gleneagle, Maroon, Cotswold, Upper Coomera, Hillview, Lindum, Jimboomba.

NORTHERN.—Innisfail, Bambaroo, Ingham, Malanda, Delta, Millaa Millaa, Manton, Peeramon.

Practically the whole of the animals selected were bred in this State, thus reducing transit expenses and giving additional encouragement to Queensland breeders of the type required.

It is pleasing to know that the stimulus thus given to the purchase of better boars has resulted in a widespread demand for boars in the two other principal breeds not previously included in the scheme, but now provided for by the Rural Assistance Board's Scheme.

At no previous period in the history of the stud pig breeding business has there been such excellent demand and sales, although the range of values has been lower than for three or four years past when pig prices generally were higher. In fact, the position has improved to such an extent that several breeders report having sold all the available stud animals, and orders have been placed by them covering the purchase of additional breeding stock.

Breeders of Tamworths and Berkshires have also benefited to an extent not previously anticipated, and prospects for the future are bright.

Application forms and all information in connection with the new scheme may be obtained from the Rural Assistance Board, Agricultural Bank, Brisbane, or through the Department of Agriculture and Stock.

"Choicest" should be only Grade of Dairy Product.

There should be only one grade of dairy product—namely, "choicest"—and the attainment of this ideal depended largely on cleanliness and good management on the farm. That was the kernel of an address by Mr. J. B. Timbs, manager of Bowthorne Butter Factory, at the recent Hunter River and Lower North Coast Conference of the Agricultural Bureau of New South Wales. In many cases, continued Mr. Timbs, the fault for products being graded lower was with the farmer, and the result was a loss to the industry.

While it was necessary for the farmer to have a good herd to obtain choicest dairy produce, there were many matters connected with the management and treatment of the animals which also had considerable influence on quality. Any cause of over-heating, for example, detracted from the value of the milk. A cow bulling, a cow chased by dogs, or one brought quickly from a lucerne paddock to avoid "bloat," might cause 50 gallons of milk to be put out when the "blue test" was applied.

Milk that was really clean could be kept for days—and even months—but as the result of the action of bacteria the quality was lowered. These organisms entered milk from the atmosphere and from dirty surroundings. In winter they did not develop as rapidly as in summer, for a temperature of over 50 degrees was more favourable for their increase. One bacteria might divide into two in twenty minutes, four in forty minutes, and each of this rapidly increasing number had to be fed on the sugars in the milk. If dirty conditions obtained anywhere in the dairy there would be millions of bacteria to start with, and after four or five hours on the road the milk would be thrown out when it reached the factory. Dusty yards were a prolific source of bacteria.

One of the things necessary to ensure that milk was kept clean was that the water used for washing the hands when milking must be clean. On the average farm the same water was used many times—sometimes as many as fifty if that number of cows was milked. The problem of the convenient supply of clean water for this purpose was a real one on many farms, but Mr. Timbs suggested hanging a 4 or 5 gallon container fitted with a brass tap between each two bails—a milk can past use for milk would do—and filling these before milking so that a supply of clean running water would be available for rinsing, not only the hands, but also the cloths used to wipe the udders after each cow. The careful wiping of each cow's udder was essential, for the udder was a very definite source of bacterial infection.

Many dairy farmers who washed their hands with care and who were particular as to the condition of the udders and even the cloths used to wipe them, failed to realise that contact of their hands with the milking stool—which probably had not been washed in its lifetime—could be the cause of millions of bacteria entering the bucket, while the handling of the bail release stick was another prolific source of bacterial infection.

It was necessary, also, that cracks in the floor of the bails be repaired, otherwise there would be accumulations of urine and milk which it would be impossible to clean. Repair work consisted of excavating the crack and filling with a cement grout.

An efficient system of cleansing dairy utensils in the milk room was a necessity The proper system was cold water, hot water and "elbow grease," and then *boiling* water. The most usual fault in regard to cleansing was that the water was boiled elsewhere than at the dairy, while a common practice was to pour the water from one can to the other till it was often quite cool. The best method was to pour, say, ½ gallon of boiling water into each, put the lid on for a few minutes, and then stand them on an iron bench inside the milk room. Wooden benches became impregnated with bacteria.

Time to Plant Trees—Their Value on the Farm.

Though their claims are so generally neglected, trees serve many important purposes in farming and pastoral areas. They may be usefully employed in the following ways:—

As windbreaks and shelter belts.

As isolated or scattered shade or shelter trees.

As a reserve supply of fodder for periods of drought.

As tree plantations to supply the timber and fuel requirements of the farm, in addition to providing a source of revenue by the sale of products.

As screens around dams and tanks to prevent silting up by dust and undue evaporation of the water contents.

As a means of preventing erosion on slopes and along the banks of creeks and rivers.

As a means of enriching worn-out or poor land.

As ornamental trees in improving the appearance of the homestead.

As bee trees.

Generally speaking, May to August are the best months for tree-planting.

Berkshire Pigs—Evolution Traced—Special Characteristics.

Trace back the history of the Berkshire and you will find that this breed has been recognised as distinct for more than a century. It is probably that, as well as the fact that these pigs have been consistently developed for their commercial characteristics, which accounts for their wonderful record.

"The Grazier," dated 1808, published a brief article on the breed, and also a print of two Berkshires exhibited at a cattle show in 1807. During the first half of the eighteenth century their principal home was among the small woods on the downs in the west of Berkshire. From there they were taken in droves by road to Oxford, Reading, and other markets. The first exportation of Berkshires was in 1825, when a settler took several head to the United States.

About the middle of the last century the colour of the breed was black and white, with a preponderance of the former. The origin of the present black body and white extremities was a friendly rivalry between breeders who attempted to get rid of the white hair on the body. Their efforts met with such success that, as early as 1856, a first-prize pen was described as: "Colour mostly black, with white legs and tails, and a few splashes of white about the body."

By 1869 the markings as we know them to-day were general in the best herds, except that small patches of white hair were allowed on the lower parts of the shoulder. In 1847 the shape of the snout was moderately dished, long, and fairly pointed. The first pedigree record for Berkshires is dated 1859, while the first volume of the Herd Book was issued in 1885 from a collection of records made by Mr. Heber Humfrey (1859-1904), one of the most prominent of pioneers, breeders, exhibitors, and judges of that day.

In the specification of the breed it is stated that the general character of the animal should indicate type, quality, and breeding. Boars should have a masculine appearance, sows a feminine one. The head should be moderately short, the face dished, and the snout broad. Width between the eyes and ears is desirable. Ears should be fairly large, carried erect or slightly inclined forward, and fringed with fine hair. The jowl ought to be light.

A good neck is fine, evenly set on shoulders, and free from wrinkles. Shoulder blades, too, should be fine and well sloping. Special attention is given to this characteristic in females. The legs should be short, straight, and strong, set wide apart, and standing well on toes. The animal should walk well. The back should be long and level, with the tail set high. Sides should be long and deep, the ribs well sprung. Broad hams, wide and deep to the hocks are desirable.

The belly should be thick with a straight underline. Depth through the heart is required. Both males and females should possess well-developed bone. The flesh should be firm without excessive fat, the skin fine and free from wrinkles, and the hair long, fine, and plentiful. Manes are undesirable, particularly in females. The colour should be black, with white on the face, feet, and tip of the tail. A crooked jaw and a rose back are both regarded as definite imperfections.—"The Weekly Times."

Paper Mulch for Pineapples.

From time to time encouraging reports concerning the use of paper mulches in horticulture have been received from overseas. In Hawaii the practice has become an important one in commercial pineapple growing. In 1930 Sydney firms handling lines of special mulch papers from America made available to the Department of Agriculture supplies for experimental purposes, and during the last three years trials with pineapples have been carried out at Grafton Experiment Farm.

A report of these trials in the current "Agricultural Gazette" of New South Wales summarises the results as follows:—

(1) A paper mulch in a dry season greatly aids in keeping the soil moist and in good condition, and enables the plant to make fuller use of the richer top layer of soil.

(2) Paper mulched plants flower and mature their fruit two to three weeks earlier than those receiving ordinary cultivation.

(3) The paper-mulched plants are more productive, and their fruits larger and of better quality.

(4) Paper mulching effects a considerable saving of time in cultivation. only occasional hand-weeding being necessary as opposed to frequent cultivation in the case of plants unmulched.

(5) With careful use the paper mulch should last several seasons; in the case of annual crops it is rolled up and put away at the end of each season.

The Meat Export Industry.

In an address on "The Past, Present, and Future of Australia's Meat Export Industry," at a recent meeting of the Hawkesbury Agricultural College Branch of the Agricultural Bureau of New South Wales, Mr. J. B. Cramsie, ex-chairman of the Meat Industry Board, said most old cattle men thought our cattle were the world's best, and this was the stumbling-block to Australia's meat export trade. Our cattle were not in any way the best, and, in fact, generally had depreciated since the war. This was mainly due to the use of the scrub bull and to deterioration in our grass lands. After travelling in every meat-producing country in the world, and thirty-five years in the industry, however, he was sure Australia could produce as good a quality meat as any other country, and more cheaply.

Australia exported only frozen meat, and her freezing works were the best in the world, but it must be definitely understood that these plants were not in any way suited for chilling beef. In the chilling of beef we had lagged behind Argentine, New Zealand, and other countries. Australia should follow Argentine and Uruguay, who forty years ago were producing as rough a type of cattle as was possible. By buying the best English bulls, however, Argentine now produced excellent meat, which was readily sold in Great Britain. Uruguay had proved the value of pasture improvement. That country was only half the size of Victoria, and yet it owned 9,000,000 cattle and 20,000,000 sheep. The best exotic grasses were introduced, and Uruguay now produced the best baby beef.

The scrub bull was a greater curse in Australia than the rabbit or prickly-pear, for it was through the use of scrub animals that Australia's beef had deteriorated so much. Of the bulls in use, 75 per cent. should be destroyed. He was a strong advocate of a "Scrub Bull Act." Argentine to-day had few bulls worth less than £40 per head, and it was because of these that her beef was so much sought after.

In regard to the Northern Territory, Mr. Cramsie said there was not one station there which had paddocks to put young growing females in. Consequently, the animals were bred too early, being thus ruined, and the steers produced were poor. Thus little hope was entertained for the Territory as an export meat producer.

Australia had had too many natural favours, and we had not learnt better methods from adversity. We stored little fodder, and failed to improve our pastures, so that when droughts occurred stock losses were enormous. New South Wales, for instance, had lost over 75,000,000 sheep from these causes, and in one drought (in 1919-20) 10,500,000 sheep perished.

If Australia was to enter the fat lamb trade successfully, then she must (1) improve pastures; (2) select only the best ewes; (3) use the best ram that money could buy. In regard to the ewes, there was no need to interfere with the wool side, and Australia's name for wool could be maintained while making a market for fat lambs. The use of a good sire was very important, as often he was responsible for 75 per cent. of the characteristics in the progeny. The motto for fat lamb producers should be "Breed the best and feed the best."

Australia must follow the agrostologist more closely to-day. With proper improvement and management of pastures we could carry three times our present number of cattle.

He was definitely in favour of country killing when properly organised. Individual centres could not hope to be successful with country killing, as there would be much opposition from vested interests, and they could not arrange for shipment successfully. There was no reason why sheep and cattle for meat export should be brought to Sydney for slaughter. This resulted in 1s. for loss in weight and quality of carcass, and 1s. in extra freight per sheep. Werris Creek could be made a country killing centre for the northern part of the State, Orange for the central part, and Cootamundra for the southern part. A great deal of organisation would be necessary to arrange for cold stores, shipping facilities, and marketing.

The only solution to the beef industry, said the speaker in conclusion, was the chilling of meat. Only a relatively low percentage of the cattle slaughtered, however, was suitable for chilled beef.

Turning Wheat into Wool.

In an address at the recent South-Western District Conference of the Agricultural Bureau of New South Wales, Mr. D. Kelly, of Quandialla, advocated placing 100 acres of a 200-acre holding under wheat, and for comparative purposes growing hay and running sheep on the other half. Costs were considered and figures quoted to show that the net return would be much greater from the area running 1,000 sheep as against the equal area on which wheat was grown. The figures given were:—

Wheat—

100 acres sown; 14 bus. crop (district average) at 2s. 10d. bus. = £200.

Hay and Sheep—

100 acres sown; 1¼ tons crop (district average) = 125 tons.

1¼ tons hay at daily ration of 1 lb. chaff per sheep would feed 10 sheep for a year. 10 lb. wool per sheep at 1s. lb. = 10s. sheep.

Therefore 1,000 sheep would give return of £500.

Header and binder costs would nearly balance, and cutting and handling hay would equal carting wheat to rail.

The loss of sheep (say 5 per cent.) would equal £50, and shearing, say, £20.

Allowing for other incidental expenses, Mr. Kelly submitted that there ought to be a substantial balance in favour of the hay and sheep project; he intimated that it was his intention to try such an experiment next year on four times the scale referred to.

Points in Rearing Calves.

Always handle calves quietly and patiently.

Feed at regular times each day and in regular quantities.

Feed only clean sweet milk—the calf is not designed to assimilate any other. Add some constituent to replace the feed value of the cream removed from the milk, and lime-water to assist digestion. Milk should be pasteurised if possible, and on no account should the froth be given to calves.

Feed the milk at body temperature. Cold milk requires a great deal of the animal's energy to heat it up to a point at which digestion can take place.

Cleanse feeding buckets as carefully as you would all other dairy utensils.

Keep the yard and its surroundings free of manure and rubbish. Such material breeds flies, and flies are active carriers of disease.

Provide shade in summer, and shelter from winter wind and rain. It is cheaper to conserve animal energy in this manner than by the use of larger amounts of food.

Always pick up any pieces of rag, paper, twine, &c., found about the calf paddock—young calves, like other young animals, are not discriminating in their diet.

Provide a suitable lick consisting of salt and bonemeal.

Marketing the Citrus Crop.

Good fruit is worthy of careful marketing, and he is a short-sighted orchardist who for want of a little final trouble jeopardises the chance of good prices for the product to which his whole year's work has been devoted. The reminder is seasonable for the citrus grower, whose attention is directed to the following important points:—

Exercise extreme care in packing.

Place fruit carefully in picking bags.

Carefully transfer fruit from picking bag to box.

See that the box has no protruding nails or splinters.

Do not jolt the fruit over rough roads.

Grade carefully for size and quality.

See that the sizing machine is functioning properly.

Use a clean case.

Pack neatly and tightly, but do not squeeze or jam fruit into boxes.

Stack cases on sides.

Herd Testing—A Woman's Viewpoint.

"A Dairy Farmeress" writes (9th July, 1934):—

"I have yet to thank you for the record of last season's results of the testing of my small herd. In some ways the results were a surprise, though in others they simply bore out my own opinion of my cows. I liked the testing—it added the factor of intelligent interest to an otherwise distasteful task, and also it gave me the opportunity of saying, 'I told you so,' on three separate counts.

"I am sending in to-morrow to request the factory manager to forward the testing bottles to start the new season's testing—some of my cows have young calves now, when their last year's calves are only eleven months old. I want to get the full period in this year.

"In your letter of 20th April (34/182), you say, 'It is hard to realise why so comparatively few dairy farmers, &c. . . .' In one issue of the 'Agricultural Journal' the same wonder is expressed and the opinion put forward that, as the free testing scheme has been in operation for so long, farmers' apathy can hardly be due to ignorance. Well, I'd like to say that, as far as my experience goes, you are wrong. I, myself, though brought up on the land, have not long been a dairy farmeress in my own right, and, though I knew there was a scheme of some sort, and believed in testing in theory, I knew nothing of the details. My nextdoor neighbour, recently moved in, has been dairying for years and knew nothing of it, and my neighbour on another boundary was equally in the dark.

"Neither of these people take the 'Agricultural Journal,' and were amazed when I told them the slight expense they'd have to incur to get it.

"The reason for their apathy is not far to seek. They regard dairying merely as a sideline—something 'the wife and kids' can fill up time with, something they themselves give a hand with when they have nothing more congenial to do. The real interest of these men lies in beef cattle. They do not as a rule buy real dairy stock. They just milk the best they can get out of their herds. The overburdened wife can be forgiven for not testing. It takes up time she ought to be spending darning the socks; and the children, poor little things, loathe milking like poison.

"Other men think they can pick a milker on appearances. One old fellow told me seriously the other day that 'the longer a cow's horns, the more milk she will give,' and also that 'you never find a tough cow a bad one'—a piece of fatalism that 'gave me to laugh,' for I was milking the toughest brute in our yard, and last season Babcock placed her at the bottom of the list. So you see?

"Last year my herd at no time numbered more than fifteen. I have fourteen in now, ten of them going on test now. By Christmas I expect to be doing between forty and sixty, and I want to test all but the obviously useless.

"I am very glad to have the facilities for testing that the Department of Agriculture offers."

Kerosene Emulsion—Its Preparation and Use.

As a general spray for scale insects on citrus and deciduous fruit trees kerosene emulsion has been largely superseded by miscible white or red oil. It can still be recommended, however, for the control of thrips and for fowl tick, fowl mites, fleas, and other vermin, states a departmental leaflet. The formula is as follows:—

Hard soap, ½ lb.

Kerosene, 1 gallon.

Water, 1 gallon.

Cut up the soap and place it in 1 gallon of water and heat until dissolved. Remove from the fire and immediately stir in the kerosene and mix until thoroughly emulsified.

For the control of thrips, aphids, &c., add this stock solution to 18 gallons of soft water (1 pint stock to 9 pints water). For fowl tick, fowl mite, and fleas, the stock solution should be added to 8 gallons of water (2 pints stock to 8 pints water). The stock solution may be diluted at once with cold water, but if allowed to stand until cold it must either be reheated or else hot water must be used to dilute it.

As kerosene is injurious to rubber, a warm solution of soda should be passed through the hose after using.

Water-storing Trees—Nature's Living Reservoirs.

Our Australian aborigines have long known that certain species of native trees are natural reservoirs containing, in some instances, quite considerable quantities of water. In the arid inland districts, and during prolonged periods of drought, it is evident such knowledge must be of great value.

Many smaller plants, such as the pigface, cactus, and the ice-plant (common along the Balonne River) conserve a proportionately tremendous quantity of water; and succulent epiphytes like orchids are capable of flourishing luxuriantly on bare rock by their ability to absorb water from moist atmosphere. Though the water-holding capacity of species such as the bottle-trees and coolibah is well known, numerous numbers of the eucalyptus family, besides the coolibah, come under this category. The list includes various species of stringy-bark, the Grey ironbark (*E. paniculata*), the popular box (*E. populifolia*), also called "Bimbil," and shiny-leaved box, the Morrel (*E. oleosa*), and at least five species of the mallees. Of the latter, the yellow or water-mallee, is perhaps the best known. The western bloodwood (*E. terminalis*) I should also have mentioned. There are, in addition to all these, the desert oak (*Hakea Grevillea striata*) and the needle-bush (*H. leucoptera*). Of the Casuarina family, *C. Deccaiseuana* is another example, and several kinds of acacia are also known which store up water in excess of the average amount. In South Queensland scrubs several members of the grape-vine family (Vitis) are quite notable, and probably *V. antarctica* and *V. hypoglanca* are the most common. When chopped into short lengths, these vines exude a surprising quantity of quite wholesome water.—P.J.B. in the "Sydney Morning Herald."

Control of Bracken Fern—Value of Kikuyu Grass.

Because of its smothering effect on all other plants in a pasture, Kikuyu grass has been found of considerable value in the control of bracken fern.

The fern country on which it is intended to grow Kikuyu should be ploughed and worked prior to planting in the spring, or if the soil be of an open, free nature the fern fronds should be cut in the early spring, burnt, and the grass roots hoed in. On large areas drills 3 feet apart should be struck out with a single furrow plough, the Kikuyu being dropped every 3 feet in the bottom of the drill, and covered with a light furrow, or by running a harrow along the drills in the direction in which they run. If the weather is at all favourable the Kikuyu grass makes headway as soon as, or before, the fern, and by winter there is only sufficient fern showing to protect the grass from frost. By the following spring a mat of grass has formed over the blank spaces, and the fern is gradually choked out.

This grass provides excellent quality feed, and although mainly a summer grower it withstands dry conditions better, remains greener for a longer period, and provides a greater bulk of feed during the winter months than does Paspalum. Kikuyu is particularly useful for planting on hillsides, as it binds the soil together, and thus prevents washing of the surface soil.

In very cold districts its growth period is limited to a few months of the year; consequently successful results can only be looked for in areas where the rainfall is fairly plentiful, and where a long warm growth period is possible.—A and P. Notes, N.S.W. Dept. Agriculture.

Animal Health Station Commended.

A North Coast correspondent writes (23rd June, 1934):—"Please accept my very best thanks for the help I have received from your station (Animal Health Station, Yeerongpilly). Some months ago I wrote to you regarding a cow with a bleeding lump in the ear. The cow was most distressed and could not chew the cud with comfort. In her irritation she would rub the ear, causing it to bleed most alarmingly. Your advice was to place spirit (rectified) in the ear and paint the lump with liquor Iodi. fort. 1-6. The result was most magical. Not only was there improvement from the first day, but after a few weeks the lump, which was as big as half a hen's egg, completely disappeared, and the cow calved normally, and is now milking well. For a cure like that one would willingly pay a good many "bull taxes." It is a great comfort to know that your body of experts at Yeerongpilly are working day and night for the benefit of us dairy farmers, and it can only be very ignorant people who object to paying a small contribution to help things along."

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

ILL-NOURISHED CHILDREN.

POORLY nourished children may be seen by the skilled observer wherever he goes, says the monthly article issued by the Queensland Baby Clinics for the guidance of those who have the welfare and care of young children. Fortunately they are usually fewer in number than the well-nourished children, but there are many of them.

Their number varies in different places and at different times, but they are always present. There are many causes of poor nutrition, but in all but a few the cause is simply defective diets. By this we do not mean that the children do not get enough food. They probably get as much as they will eat; they may even get expensive foods, but they do not get the right sort of food. Their mothers have never received a right education, and are not to be blamed for want of knowledge which no one has taught them. They are not to be blamed, but their children suffer all the same.

Want of Knowledge.

There is a widespread belief that the important foods are meat, white bread, butter, and sugar, and that all other foods are extras. Of the five necessary vitamins meat contains only one, white bread and sugar contain none, and butter, which is valuable for its vitamins, is expensive, and is being replaced by margarine. So long as times are good most people take a large variety of foods, and these often supply all that is needed in the diet. But when times are bad and thousands are on relief wages, it is only natural that mothers should concentrate on what they think the important foods. They satisfy their children's appetites with foods on which really good health is impossible. There is no starvation, but much bad feeding. Poverty is not the cause. The cause is want of knowledge, the evil effects of which are made more dangerous by want of money. The foods that are essential to children's health are only too often cut out because the mother thinks they are not important, and therefore she cannot afford to buy them. Meanwhile she spends money unnecessarily on foods of inferior value.

Milk is Necessary.

The most important of foods for children is milk, and this is often the first to be cut out. In some places poorly-nourished children have become very numerous. It is sad to see so many of the next generation being spoilt in the making—so many that will never grow strong men and women, but will help to fill our hospitals, when in later life they fall victims to all kinds of diseases—so many that will fall easy victims to tuberculosis, or become hopelessly crippled with chronic

rheumatism. The condition of their teeth will be such that all the dentists in Queensland working overtime, Sundays and holidays included, will not be able to do what is necessary. Every child under six should have a pint of good milk in some form or another daily. Every child over six should have at least half a pint, but a whole pint would be better. As it is, many families are given only a little condensed milk, or some powdered skimmed milk, in large quantites of water—a mere pretence of proper nourishment.

What can we propose for this great evil? Firstly, we must dispel this want of knowledge. Our Infant Welfare Service is responsible for all children under school age, and is doing its best to help their mothers. This work is difficult and slow, and we cannot reach mothers not within easy distance of our centres. A large number of new branch clinics are much needed. The next generation of mothers will, we hope, have been better educated before they leave school. Secondly, there are ways in which we can directly encourage the increased consumption of milk. These will be explained in our next article.

HONEY—A FOOD AND A MEDICINE.

Mr. H. Willoughby Lance, Apicu'turist, Department of Agricu'ture, West Australia, writing in the current "Journal of Agriculture," W.A., says, inter alia:—

THE human body requires a great variety of substances for its growth, maintenance, and development. The food required by growing children is much the same for all, but the food necessary for the maintenance and development of the adult may vary, according to the class of work engaged upon.

Certain classes of food are, however, required by humans of all ages, no matter what their occupation may be. One of the most important of these is the hydrocarbon group, and one of the commonest of this group is sugar. Sugar is commonly produced from the ground by growing vegetable matter. The commonest form of sugar known is that produced from the sugar-cane, and is to be found in practically every household in Australia. In European countries a large amount of household sugar is manufactured from the sugar beet. Both these sugars, however, are manufactured articles; that is to say, they are not in their natural state; they have been extracted from the cane or beet and gone through certain processes known as refining during which everything that is not plain sugar is removed.

The sugar contained in fruit and honey is just as Nature provides it and is in conjunction with certain acids and mineral salts which the body requires.

Chemically, there are three principal sugars contained in honey:—cane sugar (sucrose), grape sugar (dextrose), and fruit sugar (levulose), the last two together being called "invert sugar"—that in plain words mean that it has been inverted or changed. Cane sugar (sucrose) requires to be changed before it can be used by the human body; invert sugar has been changed and is ready for assimilation by the blood stream almost immediately it has been passed into the stomach. The sugar on our breakfast and tea tables is pure sucrose and must be acted upon by the secretions of the stomach and inverted before it can be passed into the blood stream.

Honey contains less than 2 per cent. of sucrose, and often practically none, and from 75 per cent. to 85 per cent. of invert sugar. It will thus be realised that the sugar in honey requires practically no effort to digest and the human body obtains the full benefit of the carbohydrate food. Carbohydrate foods are classed as fuel foods which supply the body with the energy needed for the various tasks it performs, rather than those whose function it is to build and repair the body. In addition to sugar, honey contains volatile oils which give it its aroma and flavour, and indicate to a large extent the plant from which it has been obtained; also a small amount of mineral matter, including magnesia, iron, calcium, phosphorous, &c. In this respect it differs from white household sugar, from which the mineral substances originally present in the plant juices have been removed by the refining process. Although the amount of these mineral substances in honey is not high, their presence must not be disregarded, as in many of the present-day foods they are entirely lacking.

As mentioned previously, honey contains both dextrose and levulose sugars, and it depends on the proportion of these and their relation to the percentage of water as to whether the honey granulates or crystallises solid, or only becomes thick, or whether a portion is solid and a portion liquid. The dextrose sugar granulates but the levulose does not. When the honey has a solid appearance all through, the levulose or fruit sugar fills in the spaces between the granules and is usually small in proportion; when part is granulated and part liquid, the levulose is greater in proportion.

Any honey that has granulated may be made liquid again by immersing the jar in water and raising it to a temperature not higher than 140 degrees F., that is to say, not hotter than one's hand can stand. The jar should not come in contact with the bottom of the vessel containing the hot water, but should stand on a piece of wood placed therein.

The value of honey is the same whether liquid or granulated—it is only a physical change that has taken place.

Another important value of honey is its inability to carry germs of any disease that attack the human frame, being self sterilising. The reason for this is that it is hygroscopic, that is to say, it attracts moisture to itself. All life contains water, even the smallest disease germ contains moisture, and if this is removed, it dies. Any germs, therefore, that may find their way into honey are destroyed by having their moisture taken from them by the honey. This is an important fact, which it is not belived applies to any other food.

Dr. Henry Lindlaker, in his Vegetarian Cookery Book, writes:—"Always the natural sugars should be used. Honey is the very best of all and should be given preference when available. Maple and pure cane syrup come next in order, then the brown unrefined cane or beet sugar. The highly refined inorganic sugars, powdered, and loaf sugars should not be used."

Sir Arbuthnot Lane, a physician on the staff of the Lady Margaret Hospital, London, in a booklet entitled "Honey for Health," says that "Honey is a food full of energy and therefore stands high as a producer of stamina and strength. Those who add honey to their daily diet may be assured that they are adding to their capacity to work with hands and brain. If every traveller would ask at his hotel for honey with his porridge or cereal foods, he would be far more fit to tackle the day's work. Honey has practically no waste matter in it. Extracted honey is one of the few foods that is all food, and is easily digested." He further goes on to say, "Where people are below par or depressed, where there is chronic constipation with absorbent poisoning, and in children's ailments, honey is a great panacea."

Another important use of honey is for cookery purposes in the place of sugar. In early days before the introduction of sugar, honey was practically the only method of sweetening known. In many countries to-day it is coming into its own for cooking purposes and is no longer a luxury. The twentieth century homemaker is dressing salads with honey, is flavouring tea fancies and cakes with honey, is baking ham for dinner with honey, and surprising evening guests with tasty honey nut sandwiches and delicious fancy cakes and biscuits made with honey.

In using honey for cooking it must be remembered that good honey contains about 17 per cent. water; therefore in mixing, less water will be required than with sugar; also that a cup of honey is heavier than one of sugar; that a cup of honey weighs 12 ounces and sugar 7 ounces, the weight of the sugar in the cup of honey being 9½ ounces as against 7 ounces in the cup of sugar.

One of the advantages of using honey in cakes is that they will keep moist for a very long period, and in fact are improved by keeping.

There are many kinds of honey in the shops, and a large number of people judge honey by its colour and perhaps mild flavour. This is a great mistake. Honey should not be judged by colour, but by its food value and flavour. The darker honeys have been proved by analysis to have a better food value generally than the lighter ones. Some of them certainly do not have an attractive flavour, but this can also be said of many of the light ones.

It is, however, largely a matter of use, and consumers are advised to accustom themselves to a medium coloured honey of heavy body. Thin honeys contain an excessive amount of water and are liable to ferment.

Summarised, the value of honey may be placed under six headings:—

It is the only natural sweetening substance on the market.

It has already been changed or digested by the bees, and is almost immediately passed into the blood stream.

It is an energy producing food.

It contains mineral and other substances, so necessary for the maintenance of health.

It cannot carry disease harmful to human beings.

It is pleasant and attractive to the taste.

The value of the regular use of honey as an article of daily diet cannot be overestimated. In addition to this it has an important value as a medicine. Doctors in Europe and America now recognise this, and use it in their regular practice. It is not used in prescriptions on account of its power to counteract disagreeable flavours, but on account of its healing and soothing qualities. It is a well known *cure for colds on the chest, influenza, sore throat, &c., taken* with hot milk or lemon.

As a cure for constipation a dessertspoonful in a glass of hot water night and morning will nearly always cure this trouble.

Being antiseptic and drawing, it is a wonderful remedy for boils, carbuncles, septic poisoning, and is used by many doctors in prescriptions for pastes for these diseases, making lancing or cutting unnecessary except in late treatment or very severe cases. A simple paste for this purpose may be made with a dense honey; preferably dark coloured, as this contains more iron and tannic acid; mixed with flour, applied to the place on a piece of lint and covered with oiled silk or jaconet and renewed two or three times a day. This has a powerful drawing action and will cause the rupture or opening of the skin, allowing the pus to drain out, and there will be no scar left. The writer has personal proof of the efficiency of this treatment in the case of severe septic poisoning. Boils are usually relieved in a few days, but carbuncles, being more persistent, may take weeks of treatment.

Similar treatment to the above is excellent for burns and scalds, and is also a cure for piles.

The following is an extract in regard to the use of honey as a cure for toothache:—"It is my honest opinion that no living person knows the therapeutic value of honey. How many persons know that is it a wonder remedy for toothache, even where one is suffering from an abscess. Just take a big swallow in the mouth and hold around the affected tooth for a while. It usually does the trick in a few minutes. I have never known it fail. I have sold numbers of people honey for this specific purpose and everyone of them, without exception, has told me that it worked like a charm." (Emmett Baxter, Philadelphia.)

Honey is also an excellent cure for bee stings, especially if applied as a paste and covered up. For frost bites on ears, fingers, &c., apply honey or honey flour paste and wrap up.

For inflamed and sore eyes, a drop or two or liquid honey put in the eyes several times has been known to bring wonderful results, when all else has failed.

Equal parts of honey and cream mixed together is an excellent cosmetic, softening and beautifying the skin, and is said to be a good remedy for freckles.

A splendid candy for colds, coughs, &c., can be made as follows:—Boil a strong solution of horehound leaves in soft water, strain through muslin, add as much honey as desired, boil until all the water evaporates, pour in shallow vessel, and allow to set.

THE KITCHEN GARDEN

To grow cabbages well plenty of manure should be used. There is no manure to which this crop responds so well as animal. For heavy lands horse manure, and for light soils cow or pig are respectively the best when they can be obtained. If the soil is of a poor quality, dig the ground two spits deep, and put a good layer of manure between the two spits. This is especially necessary in the case of autumn or summer crops, which have to stand a dry spell. Spring cabbage—that is, those that are planted in the autumn for use in the spring—do well if planted on ground that has been well worked and manured previously for peas or onions, and on such ground cabbages can be planted without any fresh manure being added. Of other manures lime is an important factor in successful cabbage culture; it is chemically and mechanically beneficial to the soil and the cabbage tuber. It should be applied at the rate of about 2 lb. to the square yard, and is particularly necessary to heavy soils and those rich in humus. Superphosphate at the rate of 2 oz. to the square yard is good, but should not be applied at the same time as lime or to soils that are infected with club root. When the crop is nicely established, apply 1 oz. of sulphate of ammonia to heavy, damp land, or 1 oz. of nitrate of soda per square yard in the case of light or sandy soil. Nitrate of soda is a splendid fertilizer for the cabbage family. When especially

fine heads are required, water the plants once or twice during the growing season with the following mixture:—1 oz. of iron sulphate and 2 oz. of sulphate of ammonia dissolved in 1 gallon of water.

Now is the time when the kitchen garden will richly repay all the labour bestowed upon it, for it is the month for sowing many kinds of vegetables. If the soil is not naturally rich, make it so by a liberal application of stable manure and compost. Manure for the garden during summer should be in the liquid form for preference. Failing a sufficient supply of this, artificials may be used with good results. Dig or plough the ground deeply, and afterwards keep the surface in good tilth about the crops. Water early in the morning or late in the evening, and in the latter case stir the soil early next day to prevent caking. Mulching with straw, leaves, or litter will be a great benefit as the season becomes hotter. It is a good thing to apply a little salt to newly-dug beds. What the action of salt is is not exactly known, but when it is applied as a top dressing it tends to check rank growth. A little is excellent for cabbages, and especially for asparagus, but too much renders the soil sterile and causes hardpan to form. French or kidney beans may now be sown in all parts of the State. The Lima bean delights in the hottest weather. Sow the dwarf kinds in drills 3 ft. apart and 18 in. between the plants, and the climbing sorts 6 ft. each way. Sow Guada beans, providing a trellis for them to climb on later. Sow cucumbers, melons, marrows, and squash at once. If they are troubled by the red beetle, spray with Paris green or London purple. In cool districts peas and even some beetroot may be sown. Set out egg plants in rows 4 ft. apart. Plant out tomatoes 3½ ft. each way, and train them to a single stem, either on stakes, trellis, or wire netting. Plant out rosellas. Sow mustard and cress, spinach, lettuce, vegetable marrows, custard marrows, parsnips, carrots, chicory, eschalots, cabbage, radishes, kohl-rabi, &c. These will prove satisfactory provided the ground is well worked, kept clean, and that water, manure, and, where required, shade are provided.

Fresh vegetables, especially vegetables containing vitamins, are essential to good, robust health, and medical men are now advising people to "eat more vegetables."

The growing of vegetables not only means a saving of money, but educates the children by inculcating a desire to have their own gardens in later life, and so help to keep down the costs of living.

Vegetable-growing is not only a healthy occupation, but it also provides exercise and recreation. In the suburbs it has a tendency to keep young people contented at home, and to trouble less about going to horse races and places of gambling. With country people who, perhaps, are less in need of exercise, gardening is a delightful hobby.

It enables private gardeners to improve the strains of vegetables by a careful selection of seed, much in the same way that a flockmaster improves his sheep; and much satisfaction, and, not unusually, generous reward, are to be gained from this work.

The home garden enables the testing out, in a small way, of the newer varieties of vegetables, which work is not always possible, or, if it is possible, not payable with the professional or commercial gardener. The amateur gardener will find this work both fascinating and health-giving.

Given suitable soil conditions, the various culinary herbs (sage, thyme, marjoram, mint, &c.) are easily cultivated in Queensland, and every garden should have at least sufficient plants for home requirements. Commercial production, too, presents possibilities, especially of those herbs which are sold in a green state, the chief of which are mint and parsley. During the winter months a demand exists for both these herbs. Under cool conditions little growth is made, and some growers have therefore resorted to production under glass, especially in the case of parsley. The increased popularity of peas as a vegetable has tended to the more extensive use of mint at all seasons of the year. Owing to the necessity for freshness in the product, the metropolitan market for mint and parsley is supplied by suburban growers.

There is some household demand for dried herbs, which are used also by butchers for the flavouring of sausages. The consumption is very limited, however, and those contemplating commercial production are therefore advised first to make sure of a market for their produce.

For the successful cultivation of herbs a rich, loamy, friable soil is necessary, and a plentiful supply of water must be available during their growing period. Wherever possible, the soil should be dug to a depth of 9 to 10 inches and should be well supplied with well-decomposed stable manure. As the seeds of all these herbs are fairly small, it is necessary to cultivate the soil to a fine tilth.

The Care of the Eyes in Western Queensland.

The subjoined notes on this important subject are by Dr. L. St. Vincent Welch, Chief Medical Officer of Schools, and are published by authority of the Hon. F. A. Cooper, Minister for Public Instruction.

Two Common Eye Diseases.

Certain diseases of the conjunctiva, or moist surface of the eyes and eyelids, are more prevalent in Western Queensland than in the districts nearer the coast. Of several diseases the chief are—

1. Acute conjunctivitis, often known as "blight," in which the eyes are red, discharging, and often swollen;
2. Trachoma, in which the inner surface of the lids becomes rough and "granular."

Under treatment the first of these usually recovers completely and rapidly, but trachoma nearly always has a prolonged course, and often causes serious loss of sight or even blindness. It is trachoma which constitutes the really serious eye trouble in the West, though no doubt the acute conjunctivitis so common in the fly season is more spectacular in appearance. Much can be done, and everything possible should be done, to prevent the occurrence of both these diseases, but especially does this apply to trachoma, for not only is it the more serious disease, but it is the less highly infectious and therefore the more readily preventable.

Reasons for Prevalence.

The greater prevalence of conjunctival disease in the West is no doubt due in part to the dryness, glare, dust, and flies, factors which either render the eyes more susceptible to disease or, as in the case of dust and flies, carry the infective material to the eyes. The difficulty of providing an ample diet containing fresh milk, meat, fruit, and vegetables probably often lowers the natural resistance and increases the susceptibility to disease, and may thus also be a factor in the occurrence of trachoma, if not of acute conjunctivitis.

The essential cause, however, of both diseases is the occurrence and conveyance of the infection for, without this infection, people in the West have quite as healthy eyes as those dwelling nearer the coast.

Great Majority have Healthy Eyes.

In a recent inspection of school children in the South-Western districts about 80 per cent. were found to have eyes that would compare favourably with those of children around Brisbane. This shows that it is neither the climate, dust, nor glare that can be blamed for 10 per cent. suffering from trachoma, and that there is no reason why everyone in the West should not have as good eyes as people in other districts.

Actually some of the centres visited, not always those most favourably situated, were remarkable free from eye disease. Every place should be free.

Need for Care to Prevent Infection.

The frequency with which whole families are affected, one or both parents showing old-standing trachoma, while other families living in similar conditions have healthy eyes shows the care that should be taken to prevent the spread of the disease as well as the benefits to be gained by taking that care.

It is plainly the duty of everyone in those parts where trachoma is prevalent to take all reasonable precautions to avoid acquiring the disease, and it is especially the duty of those who are suffering or have suffered from trachoma to take unceasing care to avoid giving it to others.

Persistent care may be tedious and troublesome, but surely no trouble can be considered too great to get rid of a serious and disabling disease. Indeed, could anything be more discreditable to a community than the continued existence of a preventable disease?

Preventive Measures.

Of all requirements in discouraging the spread of infection from one to another we may put first and foremost soap and water. Scrupulous cleanliness—a general personal cleanliness as well as of the face and eyes —is all important. Children's faces should be washed as often as necessary, and not less than thrice daily.

The eyes should, if possible, be bathed with some simple lotion—such as boracic, a teaspoonful to a pint of water—thrice daily or as often as there is any discharge to be washed away. No dried discharge—so-called "sleep"—should be allowed to remain about the eyes.

Everything must be done to prevent the infection being carried from infected eyes to those that are not infected, and it must be remembered that it is by no means easy for any person not trained in eye work to know who may or may not be suffering from trachoma in a mild form.

Separate basins and separate towels, sponges, &c., are very important. One could hardly imagine a more likely way of spreading infection from one to another than the use of the same towel to wipe the face and eyes.

For a similar reason children should not share the same bed, for obviously infection would be likely to get from one to another either direct or on the pillow and bedclothes. All possible precautions should be taken to prevent flies conveying the infection. Fly-veils should be worn during the season when flies are prevalent. Children, particularly, must be taught not to tolerate flies in and about their eyes.

When sore eyes do occur a doctor should be consulted if one is available. It is very important that all cases of acute conjunctivitis, or "blight," should be thoroughly treated until the eyes are quite healthy again, for there is some reason to suspect that trachoma is especially liable to become established during and following an attack of acute conjunctivitis.

Treatment of Affected Eyes.

It is possible only to give general directions as to treatment where the services of a doctor are not available. It must be fully understood

that all sore eyes are not cases of acute conjunctivitis or trachoma. Many other eye troubles—sometimes very serious ones—are liable to be regarded as "blight" in the West or as "a cold in the eye" in other places, and these affections may require quite different treatment. Trachoma and acute conjunctivitis are both liable to complications requiring special treatment. The proper treatment for each case could only be advised by someone with a knowledge of eye diseases, and it is important that for any sore eye a doctor should be consulted, if possible.

For the usual simple case of conjunctivitis, whether acute "blight" or the chronic trachoma, treatment is directed chiefly to assisting Nature to effect the cure, for it is undesirable, without risk of damaging the eyes, to use the strong antiseptics that could be applied elsewhere, and only mild antiseptics and treatment are advisable except in the hands of those who know what they are doing and how to use them.

To help Nature in her own defensive process, the chief thing is to keep the eyes clean and free from any irritating and infective discharge. The eyes should be well bathed with boracic lotion thrice daily; when suffering from acute conjunctivitis or "blight" the eyes should be bathed more frequently—as frequently as there is any discharge to be removed. To help in destroying germs some mild antiseptic drops are desirable. Probably the common zinc sulphate (½ per cent.) and boracic lotion obtainable at any chemist's is the most efficient and safest for use where medical advice is not available, and two or three drops should be dropped into the eyes thrice daily after bathing with boracic.

It will be understood that in those places where children receive treatment through the kindness of the teacher this does not do away with the necessity of home treatment and care, for a treatment once daily on school days is not sufficient. Moreover, the welfare of a child's eyes is the responsibility of the parents, not of the teacher, though many teachers are kind enough to help in combating the eye troubles among their pupils.

For trachoma the possible home treatment is the same as for acute conjunctivitis, but must be prolonged—in most cases probably for two years or so. The disease is so resistant to treatment and so liable to lead to permanent injury to the sight that every effort should be made to get treatment under the best possible conditions.

Of no disease can it be more truly said that prevention is better than cure. There should be no trachoma to require treatment.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

"The Farm Produce Agents Acts, 1917 to 1932."

In the matter of a breach of the above Acts by FREDERICK C. KEEHN, trading as Queensland Fruit Distributors, of Brisbane, in the State of Queensland, Licensed Farm Produce Agent.

Notice is hereby given that it is the intention of the Minister to cause the moneys or part of the moneys paid to His Majesty under the Bond given on behalf of the abovementioned on the commission by the said Frederick C. Keehn, trading as Queensland Fruit Distributors of a breach of the Acts to be paid or applied in making compensation to persons who have suffered damage by reason of such breach.

Any person having any claim in respect of such damage must produce his proof of damage to me not later than twenty-eight days after the publication of this notice.

Dated this twenty-seventh day of July, 1934.

W. GETTONS,
Registrar, Farm Produce Agents,
Department of Agriculture and Stock, Brisbane.

PLATE 128.

Brisbane River at Colledge's Crossing, near Ipswich.

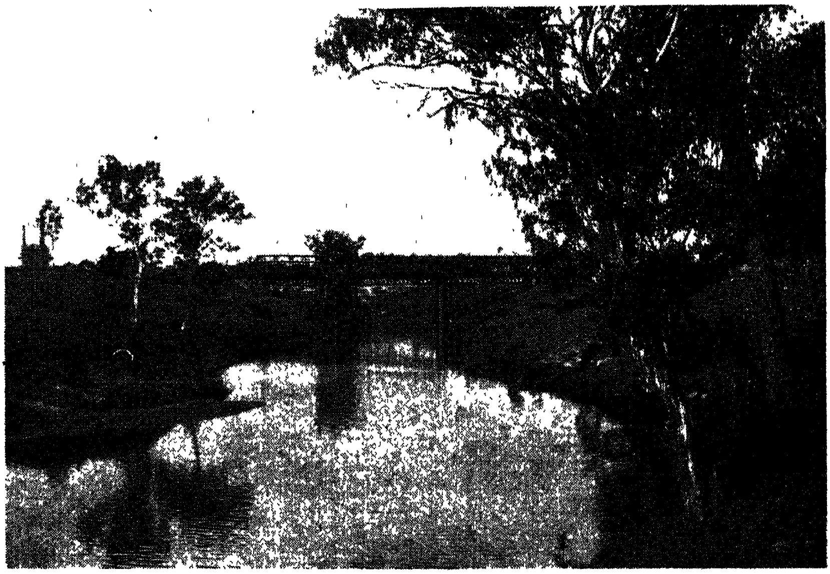


PLATE 129.
The Bremer, near Ipswich, Queensland.

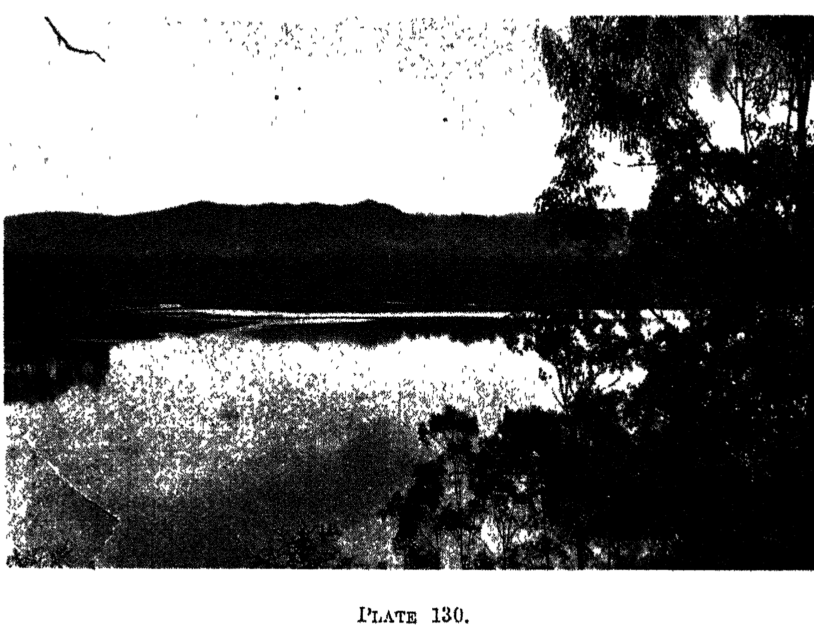


PLATE 130.
Lake Manchester, near Brisbane, Queensland.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JUNE, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING JUNE, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	June.	No. of Years' Records.	June. 1934.	June. 1933.
North Coast.	In.		In.	In.
Atherton	1·62	33	2 74	2·83
Cairns	2.84	52	1·71	4·23
Cardwell	2·00	62	3·38	2·54
Cooktown	2·02	58	0 20	1·79
Herberton	1·11	48	2·73	1·73
Ingham	2·32	42	3 83	3·30
Innisfail	7·15	53	7·49	7·75
Mossman Mill	2·13	21	1·02	3·17
Townsville	1·32	63	2 39	3·88
Central Coast.				
Ayr	1·45	47	1·40	4·13
Bowen	1·61	63	1·75	2·89
Charters Towers	1 26	52	0·52	1·45
Mackay	2·63	63	4·03	3·02
Proserpine	3·29	31	1·54	3·23
St. Lawrence	2·50	63	1·56	1·45
South Coast.				
Biggenden	2·19	35	3·52	1·59
Bundaberg	2·87	51	3·77	2·45
Brisbane	2·75	83	0·76	1·37
Caboolture	2·78	47	1·46	1·42
Childers	2·52	39	2·30	1 94
Crohamhurst	4·65	41	1·60	2·00
Esk	2 30	47	0·89	0·67
Gayndah	1·83	63	2·54	1·00
Gympie	2·72	64	1·44	1·84
Kilkivan	2·13	55	2·47	1·52
Maryborough	3·06	63	1·49	2·28
Nambour	3·89	38	1·35	2·44
Nanango	2·03	52	1·41	0·71
Rockhampton	2·59	63	2·29	1·55
Woodford	2·99	47	1 41	1·01

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	June.	No. of Years' Records.	June. 1934.	June. 1933.
Central Highlands.	In.		In.	In.
Clermont	1·69	63	1·18	3·31
Gindie	1·43	35	2·62	1 00
Springsure	1·76	65	3·04	1·79
Darling Downs.				
Dalby	1·69	64	1·60	1·02
Emu Vale	1·55	38	1·18	1·28
Hermitage	1·85	28	..	1·26
Jimbour	1·70	46	1·29	0·76
Miles	1·82	49	1·67	2·11
Stanthorpe	1·95	61	0·94	2·49
Toowoomba	2·45	62	1·11	0·71
Warwick	1·78	69	0·64	1 39
Maranoa.				
Roma	1 60	60	1 06	0 94
State Farms, &c.				
Bungeworgorai	1·38	20	0·99	0·90
Gatton College	1·90	35	0·79	1·03
Kairi	1·37	20	3·13	2·33
Mackay Sugar Experiment Station	2 34	37	2·47	3·53

J. H. HARTSHORN, Acting Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JUNE, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·96	79	69	84	5	61	25	20	2
Herberton	..	69	56	77	6	48	18	273	8
Rockhampton	30·12	74	54	81	1, 4	42	12	229	10
Brisbane	30·16	69	48	76	24	40	12	76	4
Darling Downs.									
Dalby	30 17	67	37	72	1, 23	27	11	160	4
Stanthorpe	..	59	30	67	5	17	9	94	4
Toowoomba	..	62	39	68	6	30	9, 28	111	4
Mid-Interior.									
Georgetown	29·98	84	58	89	23	48	11, 12	13	2
Longreach	30·09	75	47	84	4, 5	37	12	100	2
Mitchell	30·17	67	35	75	22	25	12	54	5
Western.									
Burketown	30·00	84	60	90	5	55	9, 13, 19, 27, 28	Nil	..
Boulia	30·08	73	47	86	21	40	19, 12	54	8
Thargomindah	30·15	66	43	78	14	34	10	98	5

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	August, 1934.		September, 1934.		MOONRISE. August, 1934.	MOONRISE. Sept. 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	a.m.
1	6·35	5·21	6·7	5·37	11·32	12·21
2	6·34	5·22	6·6	5 37	a.m.	1·17
3	6·33	5·23	6·5	5·38	12·33	2·9
4	6·32	5·23	6·4	5·38	1·30	2·54
5	6·32	5·24	6·3	5·39	2·27	3·38
6	6·31	5·24	6·2	5·39	3·20	4·14
7	6·31	5·25	6·1	5·40	4·10	4·46
8	6·30	5·25	6·0	5·40	4·55	5·18
9	6·29	5·26	5·59	5·41	5·37	5·46
10	6·29	5·26	5·57	5·41	6·10	6·14
11	6·28	5·27	5·56	5·42	6·42	6·44
12	6·27	5·27	5·55	5·42	7·14	7 13
13	6·26	5·28	5·53	5·43	7·39	7·47
14	6·25	5·28	5·52	5·43	8·9	8·28
15	6·24	5·29	5·51	5·44	8·38	9·15
16	6·23	5·30	5·50	5·44	9·9	10·9
17	6·22	5·30	5·49	5·44	9·47	11·11
						p.m.
18	6·21	5·31	5·48	5·45	10 29	12·16
19	6·20	5·31	5·46	5·45	11·18	1·23
					p.m.	
20	6·19	5·32	5·45	5·46	12·17	2·33
21	6·18	5·32	5·44	5·46	1·22	3·42
22	6·18	5·32	5·43	5·47	2·31	4·47
23	6·17	5·33	5·42	5·47	3·43	5·52
24	6·16	5·33	5·41	5·47	4·54	6·59
25	6·15	5·34	5·40	5·48	6·4	8·3
26	6·14	5·34	5·39	5·48	7·9	9·6
27	6·13	5·35	5·37	5·49	8·14	10·8
28	6·12	5·35	5·36	5·49	9·17	11·6
29	6.11	5.36	5·35	5·50	10·20	12·0
30	6·10	5·36	5 34	5·50	11·22	..
31	6·9	5·37			..	..

Phases of the Moon, Occultations, &c.

2 Aug.	☽	Last Quarter	4 27 p.m.
10 „	●	New Moon	6 46 p.m.
18 „	☾	First Quarter	2 33 p.m.
25 „	○	Full Moon	5 37 a.m.

Apogee, 9th August, at 7·12 a.m.
Perigee, 24th August, at 5·48 a.m.

The greatest astronomical event of this month will be an annular eclipse of the Sun on the 10th, to be seen best at Bulawayo, the largest town in Rhodesia, and at other places in South Africa where the ring of the Sun's face left uncovered by the Moon at the extreme phase will amount to only $\frac{7}{80}$ of its bright surface; thus permitting an annular eclipse to be seen to the greatest advantage if clouds do not intervene. As this will occur 1 hour 46 minutes after sunset at Warwick no glimpse of it will be caught in Queensland.

On the 1st and 2nd the approach of Venus to Mars will be noticeable. They will be apparently in the constellation Gemini, about 1½ degrees further north than Delta Geminorum, the star near which Pluto was discovered four and a-half years ago. Venus will be of much less brilliance than in March last and Mars far from its best.

The Moon will be passing from west to east of Venus, about 2 degrees on its northern side at 7 a.m. on the 8th.

Saturn will be in opposition to the Sun on the 18th, and will, therefore, rise very nearly at the time of sunset and set about the time of sunrise, thus being within reach of telescopes all night. The Sun's apparent movement eastward will soon bring about a change, causing Saturn to rise and set earlier, so that the earlier setting of Saturn will reduce its time of visibility by 27 minutes on the 31st.

The occultation of Antares, the principal star in Scorpio, will take place in broad daylight, about 2 p.m., on 19th August, but the Moon, being rather more than half full, high up in the north east by east, an interesting opportunity for amateurs with telescopes to find Antares on the eastern side of the Moon will be afforded.

The Moon will pass within 3 degrees of Saturn on its northern side at 9 p.m. on the 24th, but the Moon being all but full Saturn will scarcely be visible to general observers.

Mercury will be in superior conjunction with the Sun on the 26th, when it will be about 36 million miles beyond it, but not exactly behind it; Mercury then being about 1½ degrees more northward.

Mercury rises at 5.17 a.m. (1 hour 18 minutes before the Sun) on the 1st; on the 15th it rises only 35 min. before the Sun.

1 Sept.	☽	Last Quarter	5 40 a.m.
9 „	●	New Moon	10 20 a.m.
16 „	☾	First Quarter	10 26 p.m.
23 „	○	Full Moon	2 19 p.m.
30 „		Last Quarter	10 29 p.m.

Apogee, 5th September, at 4.6 p.m.
Perigee, 21st September, at 11.6 a.m.

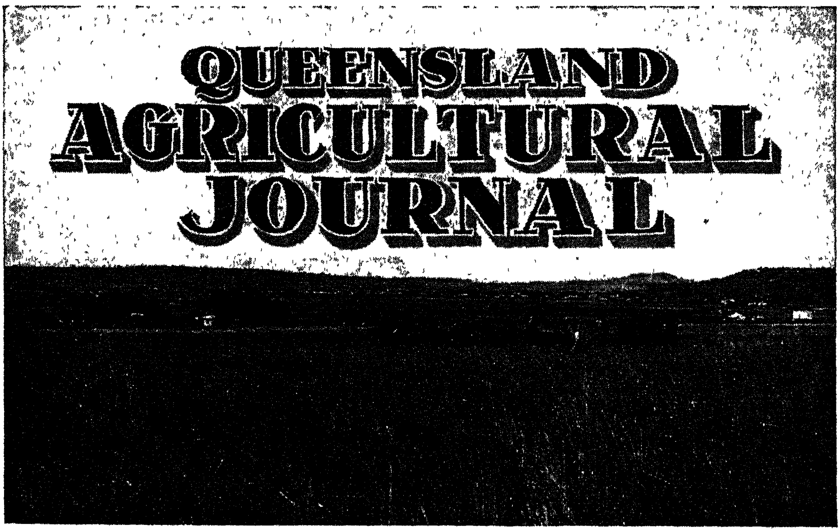
For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.



VOL XLII. 1 SEPTEMBER, 1934. PART 3.

Event and Comment.

Return of the Premier.

NO returning statesman could have had a warmer welcome home than that given to the Premier, Hon. W. Forgan Smith, by a crowd of several thousand people, on his arrival in Brisbane on 12th August from his mission to Great Britain on behalf of the primary producers of this State. The vast gathering was representative of every section of the community, and the reception accorded the Premier was remarkable for its enthusiasm and obvious sincerity. As the Sydney mail steamed into the station, the Caledonian Pipe Band played an inspiring welcome.

In the course of an address from a dais on the railway platform Mr. Forgan Smith said that he was glad to be back among the people of Queensland and to receive such a splendid greeting. He had left Brisbane for a purpose connected with the welfare of the State, and he was happy to say he was perfectly satisfied with the result of his mission.

On his visit overseas he received every courtesy and consideration from members of the British Government, from public bodies, and from the people.

He not only entered into negotiations with members of the Government, but he took the opportunity, through the press and at public gatherings, to put the case for Queensland and Australia. That case was listened to with considerable attention and sympathy, and he was satisfied that the people of Great Britain were entirely sympathetic with the people of this country. Their aims and aspirations were similar to those of Australians, and they were favourable to trade with this country. However, he found there was a great deal of misconception about Australian conditions.

"There is a feeling in Europe to-day," he said, "that is having its effect on Government policy, is preventing recovery, and is the most serious menace of all to the return to normal employment. I refer to that form of insanity known as economic nationalism—the idea that people can sell without themselves being purchasers. As a consequence barriers are being built up in foreign European countries in the hope of improving things; but inevitably the result is reflected in the poverty of their people, lack of development, and, worst of all, suspicion between nations that may lead to serious results. However, to a large extent that feeling is passing away."

While in Great Britain he pointed out that the people of that country were taking more imports from foreign countries than from all the Dominions and the Crown Colonies put together. He had told Britain that the competition of Australia in the markets of the United Kingdom was not with the local farmer but with other countries. On the figures available there was no case of any kind in favour of restriction of Dominion produce. The whole system was based on an economic fallacy, which Australia, in its own interests, must at all times resist.

There could be no justification for restricting the bounty of nature while thousands of people had insufficient of the necessities of decent livelihood. The solution of the problem lay in giving the people access to the bounty of nature, and to make use of the improvements and comforts that modern science had made available to man. Better distribution and an increase in consumption were required rather than restriction. No remedy could be found for improvement in world conditions in advocating a policy of restriction. Furthermore, Australia could never agree, as any part of a definite policy, to sharing her markets with other countries.

Any form of quotas must inevitably benefit only the older countries. As an example, in the dairying industry Denmark was the chief competitor. Denmark was carrying every hoof its pastures could carry, and any quotas based on existing output must stabilise the market for that country. On the other hand Australia's capacity to expand was unlimited, and in its own interests the nation could never agree to a policy of restricted development.

Mr. Forgan Smith added that his visit to Britain had been propitious. The case he was able to put to the British Government and, through the press and on the public platform, to the people could result in nothing but good, and the assurances he had received from the British Government were to the benefit of this country. Particularly was that true in regard to the sugar and dairying industries.

"The future is with us if we are resolute," added the Premier. "We require to do a great deal ourselves to improve the conditions of

our industry. We must produce goods of excellence and make known their merit to possible customers. That could be done by the organisation of markets in parts of Britain.''

Generally he was satisfied with the result of his mission, and he was looking forward with restored health to carrying on his work for the development of Queensland. Lands he had visited were confronted with problems similar to our own, but his considered view, as a result of his experience, was that it was a grand thing to be connected with such a country as Queensland and a great privilege to be a citizen of Australia.

Animal Health—Research Work at Yeerongpilly.

DISCUSSING the invaluable research work being done at the Animal Health Station at Yeerongpilly recently, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said, *inter alia,* that the modern conception of nutrition is entirely different from the views earlier held. A hundred years ago foodstuffs were not recognised very definitely in relation to their food values, but every country in the world to-day is endeavouring to demonstrate the economic importance of food, and to see that every food constituent is in its right proportion to every other constituent. Research work along those lines is likely to help the production of stock in the most economic way. For instance, it is well known that protein is the most expensive constituent in the balanced ration; and, that being so, it became necessary to determine the minimum amount of protein that should be fed. In order that the stockowners in Queensland may be advised on this most important matter an officer is stationed at Yeerongpilly whose sole duty consists of compiling experimental data in relation to foodstuffs.

At the present time his work is confined to observing the effects of foodstuffs on pigs and poultry, and already some remarkable data have been assembled. There is every reason to anticipate valuable results from this research, benefiting not only pig and poultry raisers, but animal husbandmen generally.

Research also was being prosecuted at Yeerongpilly with respect to parasite life in stock, which was likely to lead to valuable and important results.

One thing necessary is the creation of a public conscience among farmers so that the work done at Yeerongpilly may be duly appreciated, for experience has shown that farmers will not avail themselves of an organisation unless they know something about it.

It has been the practice, therefore, during the past twelve months, to invite leading dairymen from different parts of Queensland to come to Yeerongpilly and stay several days there. Many classes have been held, in which there has been a happy combination of practical work and theoretical instruction, with most gratifying results. Farmers who had taken advantage of this opportunity went back to their own districts very favourably impressed with the organisation at Yeerongpilly, recognising that it was a very definite and valuable help to the farming community.

Invaluable service also was rendered by the staff of Yeerongpilly, both to the farmers and to the community in general, by the diagnoses made of stock diseases at the animal health station. Arrangements had been made whereby primary producers in any part of the State

Rice Weevil in Maize.

ROBERT VEITCH, B.Sc.Agr., B.Sc.For., F.R.E.S., Chief Entomologist.

THE rice weevil, *Sitophilus oryzæ* L., is quite definitely the most destructive grain pest in this State, its unenviable reputation being due mainly to the fact that it inflicts very severe losses on maize and wheat.

As its name indicates, it was originally found attacking rice, but in the years intervening since it was first studied many other foodstuffs have been recorded as being attacked, maize, wheat, oats, barley, sorghum, macaroni, biscuits, and prepared breakfast foods being the most frequent sufferers.

Stanthorpe readers will remember that during the 1931-32 season the rice weevil was quite frequently found attacking apples both in the packing sheds and on the trees. Although the weevil grubs were often found feeding in the fruit no weevils were bred from such apples, but the blemishes were sufficient to warrant the rejection of attacked fruit. Such an occurrence is, of course, rather unusual, but it serves to indicate the wide range of foods subject to attack by this notorious pest.

Although commerce has ensured world-wide distribution from its Indian home, the rice weevil is predominantly a tropical and subtropical species, and in such regions it breeds more or less continuously and soon destroys suceptible grain left unprotected from its ravages.

Life History.

The first point of interest to be noted in the life history of this species is the fact that the weevil lives for about four or five months and during that time it can lay as many as four hundred eggs. Each of these eggs is deposited in a very small cavity gouged out by the weevil on the surface of the grain, each egg cavity being cemented over by a secretion which makes its detection somewhat difficult. As a reasonably large proportion of these eggs hatch it is obvious that even a small initial infestation may rapidly assume serious proportions, particularly during the warmer weather.

A soft white legless grub hatches from the egg after an incubation period of a few days and proceeds to feed inside the grain. This grub becomes full-grown in two or three weeks and then transforms to the pupa from which the final stage in the insect's life, namely the weevil, emerges a week later to feed, mate, and repeat the life cycle. The weevil is a dark-brown hard-bodied insect about one-sixth of an inch in length with a long downwardly projecting snout, a further characteristic feature being the occurrence of four reddish spots on the back. These lighter patches are not present in the closely allied species known as the granary weevil, *Sitophilus granaria* L., which furthermore is slightly larger than the rice weevil and is unable to fly. The granary weevil possesses habits similar to those noted in the discussion of the rice weevil, but seems partial to colder regions whereas the rice weevil, as already indicated, shows a marked preference for warmer countries.

The life cycle of the rice weevil may be completed in less than a month, but such rapid development occurs only during summer, and in the colder weather a much longer period is required for its completion. The number of generations occurring in Queensland each year is not definitely known, but overseas, under somewhat comparable conditions, there are usually six or seven generations annually.

Serious infestation may reduce large masses of grain to an almost valueless powder, and this is particularly so when grain is unavoidably subject to long storage or to prolonged voyages in slow cargo vessels. Much the greater part of the damage is inflicted by the weevil grubs, but the weevils themselves also nibble at the grain, thereby assisting their offspring in the work of destruction.

Control Measures.

Measures for the control of this pest may be discussed under three headings—firstly, cultural practices tending to minimise infestation of the crop in the field; secondly, fumigation of the stored grain once it has become infested; and, thirdly, natural control by insect enemies of the weevil.

It will probably be most satisfactory to dispose of the natural enemies first, because the control measure constituted by these natural enemies is quite the least useful of the three just mentioned. Not infrequently small wasp parasites are bred from infested grain, but the general experience is that such parasites do not become at all common until the grain is very heavily infested, and the damage has then pretty nearly reached its peak. The writer has frequently observed the same disappointing late association of parasites with the pea and bean weevils commonly responsible for the almost total destruction of cowpea seed. It may be taken as practically certain that the possibility of reasonable control by parasites offers no prospects of success.

Turning now to measures which may be taken to minimise infestation of the growing crop, it is interesting to note that the rice weevil does not usually eat through the husks of maize; hence where the choice is possible a maizegrower should select a variety producing a long, tightly fitting husk. The next important point is to ensure that any maize crop exposed to attack is harvested as soon as it is mature, thereby reducing to a minimum the period of exposure to danger. The third important point is to eliminate as far as practicable the sources of infestation in a new crop, and in this connection the best procedure is to destroy as much waste maize material as possible, both in the field and in the barn. In such waste material the weevils can continue breeding on a large scale during the period elapsing between crops. It is here necessary to emphasise a fact that is not well known, and that is that the rice weevil possesses well-developed wings and is capable of flying, more particularly during warm weather. In late spring and early summer rice weevils leave infested barns and other grain stores and migrate to the fields of maize where they initiate an infestation which may subsequently become very serious if conditions are favourable to the development of the insect; hence the desirability of ensuring a thorough clean-up of maize stores in the vicinity of growing crops.

Even if all precautions are observed infestation of the harvested maize may occur, but nevertheless if it does ensue it should be on a lesser scale than would have been the case had no precautions been

The third control measure is fumigation of stored grain, and for such a purpose carbon bisulphide is probably the most useful fumigant available under Queensland conditions.

Satisfactory results are obtainable by such fumigation, but they may be disappointing if the temperature is below 60° F., and it is generally considered that a temperature of at least 70° F. is required to obtain a reasonably good kill. For this reason fumigation should not be undertaken in cold weather, and it should start in the morning so as to obtain the benefit of the higher day temperatures.

The maize to be treated for insect infestation is placed in a suitable container, which should be as airtight as possible. The carbon bisulphide is then poured into saucers or other dishes placed on top of the grain, so that the carbon bisulphide gas, which is heavier than air, will diffuse throughout the container, which should be immediately tightly closed. Pouring the carbon bisulphide on to a few bags placed on top of the maize to be treated is sometimes preferred to pouring the fumigant into saucers, as the liquid volatilises more rapidly from the surface of the bags than from the saucers. The required lethal concentration of the gas is thus obtained earlier than is the case where saucers are used.

The general practice is to allow 4 or 5 lb. of carbon bisulphide to each 1,000 cubic feet of the container, the duration of the fumigation being thirty-six hours. The fumigated maize should then be exposed to the air to remove the gas. The germination of the maize is not normally affected by this treatment if dry and mature when treated and if the precaution of airing the seed after treatment is observed. Where infestation is severe a second fumigation may be necessary two or three weeks after the first.

The quantity of carbon bisulphide required for each 1,000 cubic feet of the container has been given as 4 or 5 lb., but it is necessary to add that such a figure is based on the assumption that the container is reasonably airtight. If the owner suspects a high degree of leakage then the quantity of carbon bisulphide should be increased.

Obviously, reinfestation of fumigated maize may ensue if steps are not taken to prevent it; hence the usual procedure is to store the treated grain in thoroughly clean and closely-sealed containers, giving little chance of reinfestation.

Before leaving the subject of carbon bisulphide fumigation readers are reminded that this chemical must be handled with a certain amount of discretion. It evaporates rapidly on exposure to the air and forms a gas which is highly explosive and inflammable. Farmers using it should, therefore, make certain that it does not come into contact with a flame or highly heated pipes, or any other highly heated material. Furthermore, it is desirable to refrain from smoking when using carbon bisulphide. The operator should also make every effort to avoid inhaling the gas, for serious consequences will ensue if this precaution is not observed. With the exercise of common sense, however, the fumigant can be handled with quite a reasonable degree of safety.

Other fumigants are available for dealing with grain infested by the rice weevil, but they are not likely to displace carbon bisulphide under existing Queensland conditions. Heat treatment may also be

used for eliminating weevil infestation, a temperature in the vicinity of 140° F. being sufficient to kill the weevils if maintained for several hours. Generally, however, facilities for the application of heat treatment on an extensive scale are not available.

So far attention has been devoted almost exclusively to weevil infestation in maize, mainly because such infestation is a more or less permanent state of affairs in Queensland. Wheat, however, may sometimes be very severely attacked while in store, although large quantities of that cereal are often absolutely free from infestation. In this connection it is interesting to note that the rice weevil reacts very markedly to the moisture content of the grain in which it is breeding, and the low moisture content of many wheat crops prevents its breeding therein. Furthermore, infestation of the growing crop is not a menace as is the case with maize; hence a wheat crop harvested in a sound, dry condition and maintained in such a state under adequate storage precautions normally has a reasonably good chance of remaining commercially free from infestation.

STRAINING WIRE NETTING.

A simple and efficient wire-netting fence is shown in the drawing. It consists of two lengths of 2 inches by 6 inches wood with two or three bolts passed through them so that they can be securely clamped to the end of the fencing as shown. A

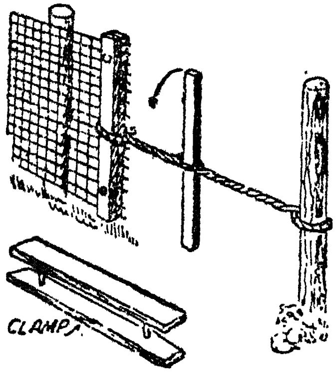


PLATE 131.

heavy rope is passed round both pieces, around a fence post, and tied. A stout stick is used to twist the rope, thus, pulling the fence as tight as desired. The device can be made in a short time from material that can be found on every farm.

Sterility in Dairy Cows.

By K. S. McINTOSH, H.D.A., B.V.Sc., Veterinary Officer, Animal Health Station, Yeerongpilly.

FROM observations made by field officers of the Department and numerous inquiries at this Station it is evident that sterility among dairy herds of Queensland is fairly widespread.

The losses due to sterility are not spectacular as in the case of rapidly fatal diseases, but their very insidiousness often allows the condition to become well established before any action is taken by the stockowner.

The lack of accurate breeding records and the reliance of the dairy farmer on memory tend to make him overlook irregularities in breeding, but the economic loss caused by sterility throughout dairy districts must amount to an enormous sum each year, and it is only by intelligent and energetic individual effort on the part of dairy farmers that it can be combated.

In this short series of articles it is proposed to deal separately with each factor causing sterility to enable the farmer to deal with the problem in an intelligent manner.

The losses from sterility are due to—

1. Loss of milk supply.
2. Inability to regulate milk supply during the season.
3. Annual loss of calf.
4. Time and money lost on treatment sometimes of hopeless cases.
5. Loss of cattle (for slaughter) which fail to breed.
6. Greater strain imposed on the bull in an endeavour to get cows in calf.
7. Waste of fodder and pasturage for cattle that will not breed.

Breeding Organs of the Cow.

To understand the fundamentals of sterility we must first make a brief study of the anatomy and physiology of the breeding apparatus.

In the cow the breeding organs consist of the ovaries, Fallopian tubes, uterus, vagina, and vulva.

Reference to figs. 1 and 2 gives some idea of the relation and position of these organs.

The ovaries are small solid organs, one on each side, about the size of small almond nuts.

These during sexual heat produce the female ova or eggs which are very small cells. These ova travel down the tiny Fallopian tubes where one of them comes in contact and fuses with one of the male cells or sperms which have been introduced into the cow's vagina by the bull during service.

The male germ cell or sperm after being deposited in the vagina swims, by means of a tail, through the neck of the uterus and into the

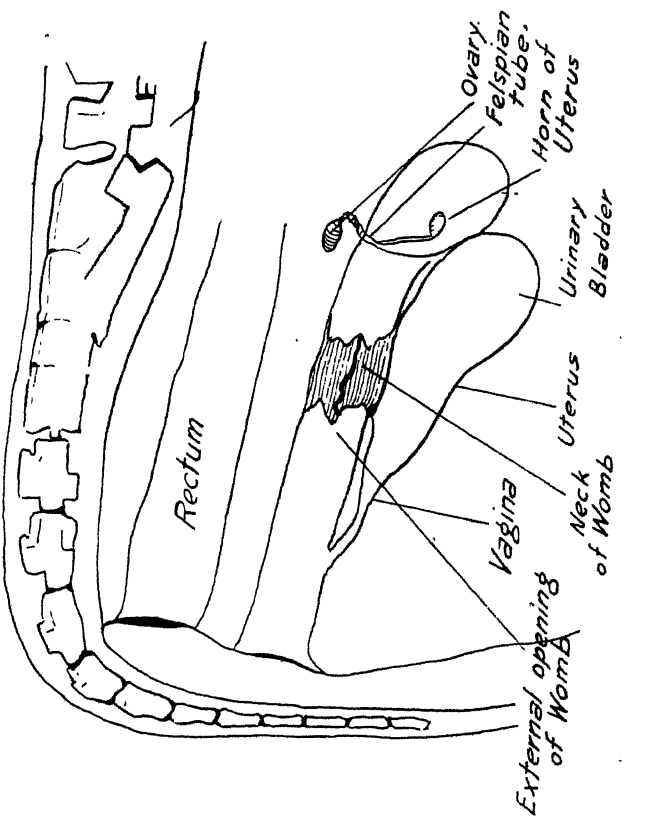


FIG. 2. (After Sisson.)

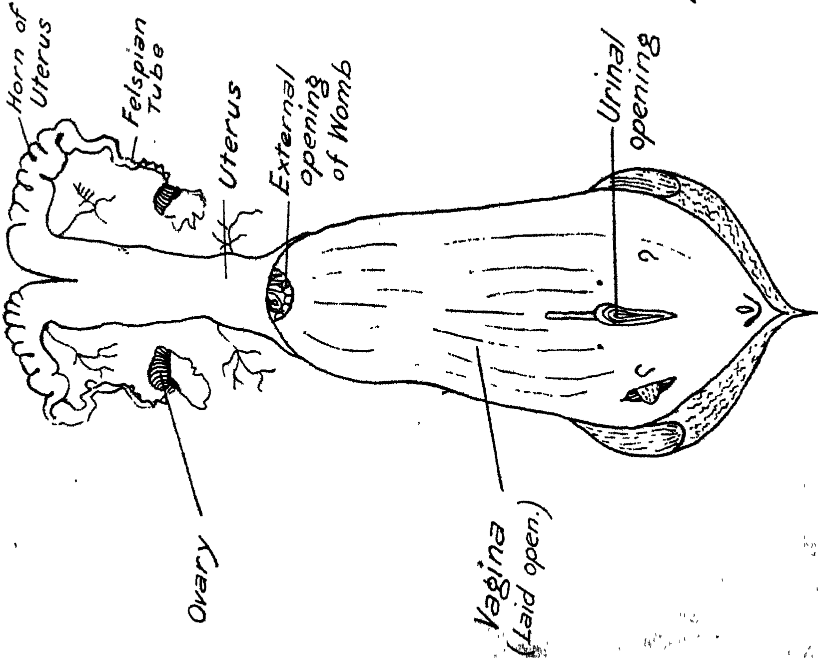


FIG. 1. (After Sisson.)

body of the uterus. It is either here or in one of the Fallopian tubes that it unites with the female cell or ovum. This process of union of the male and female cells is known as conception or fertilization.

After conception the fertilized ovum begins to divide and multiply

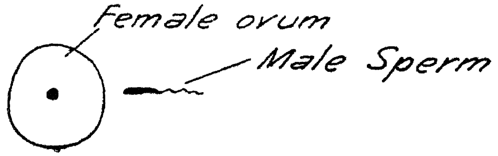


PLATE 133.

and attach itself to the wall of the uterus. From this it derives its nourishment, and, after considerable multiplication and growth, the young calf or fœtus is formed.

Causes of Sterility.

It will be seen by the foregoing that anything which prevents the union of the male and female cells or the attachment of the fertilized female cell to the wall of the uterus will cause sterility.

Conditions which cause sterility therefore may be divided into—

1. Diseases of the ovary.
2. Diseases of the uterus and Fallopian tubes.
3. Diseases of the vagina.

In the next article it is proposed to deal with diseases of the ovary and diseases of the uterus and Fallopian tube.

These will include contagious abortion, retained afterbirth, and septic conditions of the uterus.

A WIRE SPLICER.

The illustration shows a wire stretcher and splicer which has been used with success. Take a piece of ¾-inch rod 18 inches long and drill a ¼-in. hole 1 inch from one end to receive the wire to be stretched. Flatten the other end and drill a

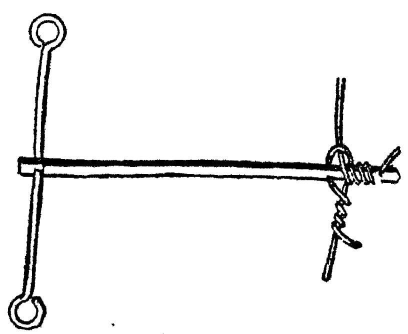


PLATE 134.

$\frac{7}{16}$-inch hole to receive a ⅜ by 18-inch rod for a handle. Put it through and turn the loops on each end. The illustration shows how to use when repairing a broken wire. It can also be used as an ordinary stretcher.

Milk Fever.

K. S. McINTOSH, H.D.A., B.V.Sc.

Causes.

THE cause of milk fever is still obscure, many theories have been forwarded and many rejected. The general opinion, however, is that the enormous drain on the body resources, due to the formation of the calf, and the sudden production of large quantities of milk lowers the calcium content of body tissues and fluids resulting in the muscular spasm and paralysis of milk fever.

The sugar content of the animal seems to be closely allied to its calcium content, and some observers believe that a sudden reduction of animal sugars is responsible. Both schools of thought produce evidence to support their claims. Hence the most recent treatment is the intravenous injection of Calcium gluconate, which treatment is producing very good results.

Symptoms.

Usually the best producers are affected, the symptoms occurring within two days of calving. In mild cases staggering and paddling of the feet is noticed, and, if treated at this stage, practically all recover. Some animals show a short period of excitement and others do not. The cow goes down and cannot rise. There is a profuse flow of saliva, grinding of teeth, the neck is usually stiff, the head being carried high or turned toward one flank. In bad cases the cow is completely prostrated and lies stretched out on the ground. Secretion of milk may or may not cease. If the temperature be taken at this stage it will probably be below normal, thus "milk fever" is not a true fever.

The effects of an attack of milk fever are either death or complete recovery. Fortunately the treatment described below is fairly effective and very few cases are lost.

If antiseptic precautions are not carried out in detail, however, the treatment may be followed by an attack of mammitis.

Treatment Preventive.

Do not overfeed cows in calf. The cow should be in good condition but not fat. See that her bowels are functioning properly, and, if not, give *small* doses of epsom salts, green feed, &c. Give the cow a plentiful supply of sterilised bonemeal at all times. This assists her to maintain her supply of calcium. If milk fever is anticipated, do not strip out the cow completely for several days after calving.

Curative.

Remove any milk and inflate the udder with air. This may be done by means of a special pump, or failing this, with a bicycle pump or human enema syringe with a rubber tube and teat syphon attached. The apparatus consists of an air pump, a cylinder containing sterilised

(or medicated) cotton wool, a rubber tube, and a teat syphon (see diagram).

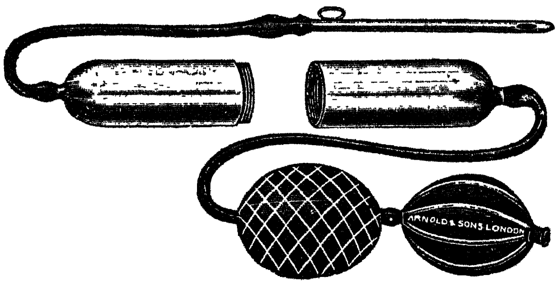


PLATE 135.
MILK FEVER AIR FILTER WITH BELLOWS.

It is extremely important that the teat syphon should be thoroughly boiled immediately before use and the operator's hands well washed.

The external opening of the teat is wiped clean with methylated spirits, the syphon is inserted, and the udder inflated until fairly firm. After all quarters have been inflated the udder is massaged gently to distribute the air.

The cow should be propped up on her brisket by means of bags of chaff or straw and turned over to the other side every hour or two. The manure should be removed by means of an enema or by hand. If she has not stood up within six hours repeat the inflation.

For several days after an attack the cow should be given green feed and bran mashes and should not be stripped out but only a moderate quantity of milk removed.

On no account should a cow with milk fever be given any medicine by the mouth.

QUEENSLAND SHOW DATES, 1934.

September.

Enoggera, 1st
Imbil, 7th and 8th
Ingham, 7th and 8th
Pomona, 12th and 13th
Innisfail, 14th and 15th
Mareeba, 20th and 21st
Beenleigh, 20th and 21st
Rocklea, 22nd
Malanda, 26th and 27th
Kenilworth, 29th

October.

Southport, 5th
Millaa Millaa, 5th and 6th
Tully, 12th and 13th

The Parasites of Sheep.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

THE more important external parasites of the sheep in Queensland consist of lice, the sheep ked, the scrub tick, and the sheep blow-flies.

SHEEP LICE.

Two species of lice are known to be present among sheep in Queensland, the red-headed sheep louse, *Bovicola ovis* L. (*Trichodectes sphærocephalus* Nitzsch), and the foot louse, *Linognathus pedalis* Osborn. They belong to the order Anoplura. The red-headed sheep louse is a member of the suborder Mallophaga, which includes all those species of lice known as biting lice.

The foot louse belongs to the suborder Siphunculata, which includes the true blood suckers. In this group the mouth parts are formed for piercing the skin and sucking up the blood and fluids.

Description.

The red-headed sheep louse has been long established in Queensland, and is a small flattened insect about one-twenty-fifth of an inch in length (Plate 136, fig. 2). The head is broader than long, reddish in colour, with prominent eyes and short three-segmented antennæ. The abdomen is pale-brownish, with a number of darker transverse bands. The legs are short and yellowish, with one terminal claw. This is the more common sheep louse, and is to be found close to the skin among the wool of the neck, shoulders, back, and thighs, though in cases of severe infestation it may occur on all parts of the body.

The foot louse has appeared among Queensland sheep only within recent years, and as yet does not appear to be by any means common. This louse (Plate 136, fig. 3) has a short bluntly pointed head, about as wide as it is long. It is much longer and broader than the biting louse, measuring up to one-twelfth of an inch in length. The mouth parts are formed for piercing and sucking. The antennæ are prominent and five-segmented, the terminal segment with three or four bristles. Eyes are absent. The legs are strong, terminating in a powerful claw. The front pair of legs are the smallest, the hind pair the largest. As in all lice, wings are absent. As its name infers, it is to be found about the feet and undersides of the legs towards the belly.

Life History.

The life histories of all species of lice are very similar, that for each species differing only in detail. The eggs, commonly known as "nits," are fastened by the female to the hair, wool, or feathers of the host. After an incubation period of several days the eggs hatch and the young lice appear. They resemble their parents except in size, and reach sexual maturity by a series of moults or castings of the skin.

The eggs of the red-headed louse hatch in from six to eight days, though in cold weather they may take as long as ten days. Sexual maturity is reached in sixteen to eighteen days after

In the case of the foot louse the eggs hatch in ten to eighteen days, the average period of incubation being about twelve days. The young lice begin to lay eggs when they are eleven to twelve days old.

Means of Spread.

Once present in a flock lice spread very rapidly. Most cases of lice infestation occur from direct contact, but it should not be forgotten that it is possible for clean sheep to become infested from yards, sheds, and paddocks which have previously housed lousy sheep.

The lice spend the whole of their life on the sheep, and can live only a short time off the host. When removed from the sheep, sucking lice live about three or four days, and biting lice six to eight days. Under such conditions the lice do not continue to lay eggs, but eggs attached to wool may continue to hatch for three weeks or longer when detached from the sheep and kept in a warm place. Young lice will live only three or four days off the sheep. Thus it will be seen that paddocks and yards containing scraps of wool detached from the sheep when rubbing and biting themselves may remain infective for at least twenty-five days. Shearing-sheds in which lousy sheep have been shorn are probably one of the greatest sources of infestation. During the process of shearing and handling the fleeces some of the parasites become detached and tags of wool containing lice and eggs are scattered throughout the shed. During cold weather dislodged lice and eggs are usually not a source of danger, as the lice become inactive and the eggs fail to hatch. This also applies to infested yards and paddocks. During warm weather, as previously mentioned, the shed may, however, be a source of infestation for twenty-five days or more.

Control and Eradication.

As lice are the cause of a fairly heavy economic loss to the sheep industry, it should be the aim of any grazier possessing lousy sheep not only to control them, but to eradicate them altogether. If clean sheep are to be introduced into an infested property, they should be placed in a paddock which has been spelled at least thirty days. By a system of paddock rotation and, of course, dipping, the eradication of lice is by no means a difficult matter. Particular attention to cleanliness in the shearing-shed is essential. If clean sheep are to follow infested sheep after shearing, there should be an interval of thirty days between shearings. If this is not practicable, the shed should be thoroughly cleaned out, all loose wool gathered and burnt, to be followed with a liberal washing out with boiling water and a good disinfectant.

For biting lice two dippings at an interval of fourteen to sixteen days are considered sufficient to eradicate them from a flock. With the foot louse, on the other hand, owing to the extended incubation period of ten to eighteen days, and to the comparatively short maturity period of eleven to twelve days, it is necessary to dip three times at ten-day intervals. Should this be impracticable with large numbers of sheep, a second dipping after the interval recommended for the biting louse will be found to give good results.

THE SHEEP "TICK."

The sheep "tick" or ked, *Melophagus ovinus*, is not really a tick, but a wingless fly. Ticks have eight legs, an inconspicuous head, and a

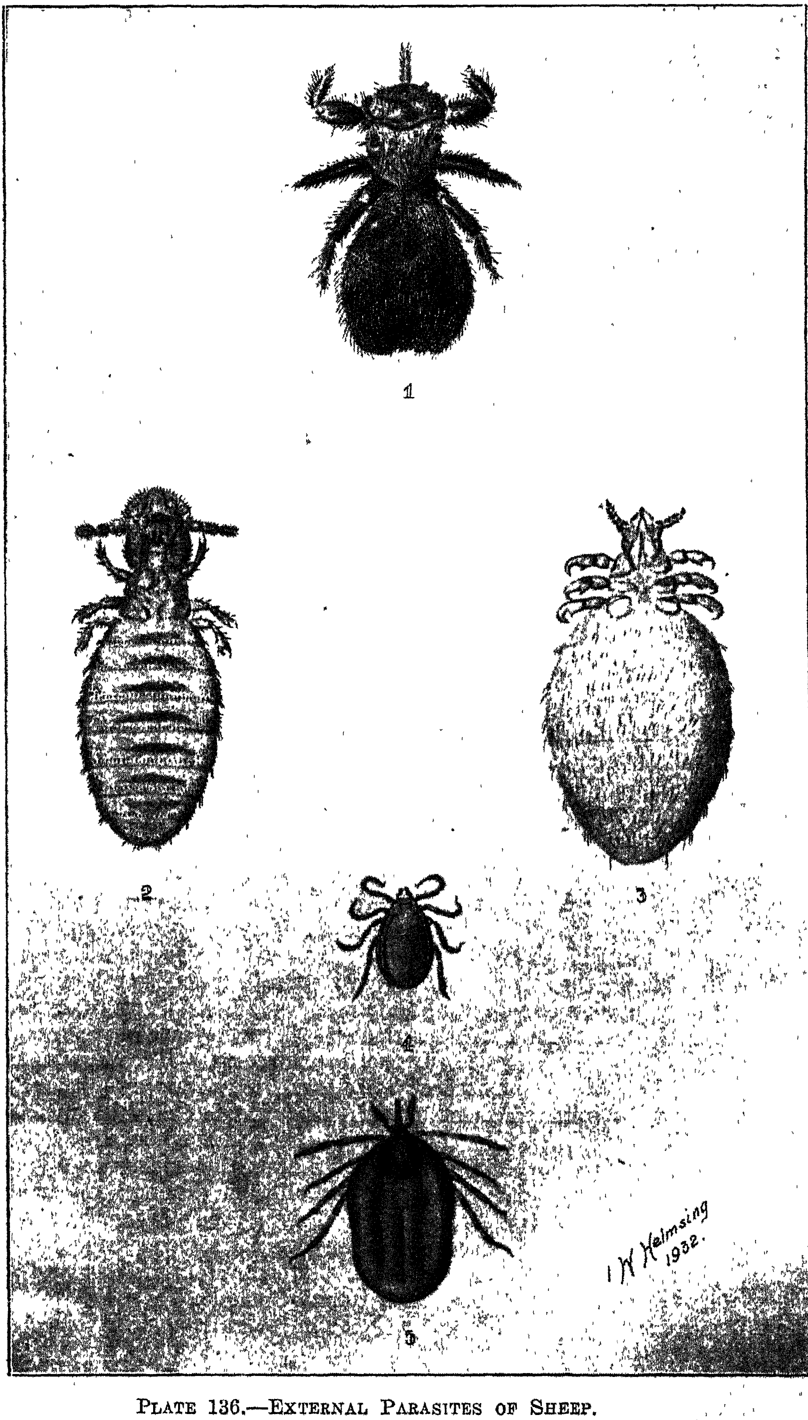


PLATE 136.—EXTERNAL PARASITES OF SHEEP.
FIG. 1—Sheep "Tick" or Ked, *Melophagus ovinus* Linn., × 7.
FIG. 2—Red-headed Sheep Louse, *Bovicola ovis* Linn., × 23.
FIG. 3—Foot Louse, *Linognathus pedalis* Osborn, × 23.

fused thorax and abdomen, while the ked has only six legs and a distinct head, thorax, and abdomen. This parasite belongs to the Dipterous family Hippoboscidæ, members of which, generally known as spider or louse flies, occur on a great variety of animals, especially birds. In colour the ked is reddish or grey-brown, and may measure up to one-quarter of an inch in length (Plate 136, fig. 1). The head is small and sunk into the thorax. The abdomen is comparatively large, especially when the insect has just fed. The mouth parts are constructed for piercing and sucking, and the insect lives on blood. It is capable of moving fairly rapidly among the wool, and its movements forwards and sideways are distinctly crab-like. Keds appear to be most numerous among the wool of the neck, breast, shoulders, belly, and thighs.

Life History.

The female sheep tick is curious in that instead of an egg it lays a fully-matured larva, which is enclosed in a soft white membrane. This is, strictly speaking, a pupa, but is commonly known as the "egg." The true egg, however, is retained within the body of the female and hatches there. Seven to ten days after the egg hatches the pupa is laid and is attached to the wool by a glue-like substance. In about twelve hours the white membrane hardens and turns brown. After a period varying from nineteen to twenty-four days, depending upon the season of the year, the adult fly emerges from the pupa. In thirteen to twenty-three days after emergence the female lays her first pupa. The life cycle is, therefore, egg and larval stage within the female insect, seven to ten days; pupal period nineteen to twenty-four days; and laying of first pupa thirteen to twenty-three days after emergence. The female deposits her pupæ, for a while at least, at the rate of one every nine days, but the total number she is capable of laying is not known.

Control.

Like the lice, the ked spends the whole of its life upon the sheep, and is incapable of breeding elsewhere as is frequently thought. The adult insect, however, has been known to live as long as eighteen days when detached from the sheep, though usually the survival period rarely extends beyond four or five days. The pupæ have been known to remain viable for as long as forty-six days in tags of wool which have become removed from the sheep by biting and scratching. Here again, as in the case of lice, sheep may become infested in two ways—either by direct contact with infested sheep, which no doubt is the chief method of spread, or from yards, sheds, and paddocks which have housed infested sheep. In order, therefore, to make sure that such yards, sheds, and paddocks are clean, it would be necessary to spell them during the warmer months for a period of about two months. During the winter, however, if the temperature drops to freezing at any period during the day or night, adult ticks will not survive longer than about five days, and as pupæ are readily killed by frosts, such infested yards, &c., need not be spelled longer than a week. Shearing-shed sanitation is again stressed.

In order to get the best results from dipping, it is necessary to dip twice. The second dipping is required as, although the first dipping will probably kill all the adult ticks, many of the pupæ will survive and form a nucleus of reinfestation. The second dipping is recommended twenty-one to twenty-five days after the first.

THE SCRUB TICK.

Three species of ticks have been recorded as attacking sheep in Queensland—namely, the cattle tick, *Boophilus microplus;* the brown dog tick, *Rhipicephalus sanguineus;* and the scrub tick, *Ixodes holocyclus.* Of these the scrub tick (Plate 136, figs. 4 and 5) is the only one of importance, and at times may be responsible for heavy losses among flocks in ticky areas. *Ixodes holocyclus* is confined practically to the scrubs of the eastern coast, and not only is it regarded as a serious pest of sheep in these areas, but may also cause fatalities among dogs, cats, foals, calves, and even man. On sheep it is usually to be found on those parts of the body not covered by wool, but when very numerous may be located anywhere on the skin surface.

Life History.

The natural hosts of this tick are the native marsupials which are to be found in the scrubs. The tick is known as a three-host tick, which means that it drops from the host in order to undergo the moults which terminate one stage in the life cycle and commence another, reattaching itself to another host at the completion of the moult. The female when replete drops from the host on which she has been feeding, and after a period of about eleven to twenty days commences to lay her eggs, as many as 2,500 eggs being deposited. In warm weather the eggs hatch in from forty-nine to sixty-one days. The tiny larva or seed tick which emerges has only six legs (adults have eight), and, after remaining quiescent for about seven days, attaches itself to the first suitable animal that comes along and commences to feed. In four to six days the larva is fully fed, drops from the host, and seeks some sheltered spot, remaining there for nineteen to forty-one days, when it moults, and this time the first eight-legged stage appears—the nymph. The nymph in its turn attaches itself to another animal, and after feeding for four to seven days, drops to the ground and moults again at the end of another twenty-one to seventy-one days. This time the moult produces the adult tick, which in another seven days commences seeking for the final host.

Injury.

The danger of scrub tick attack lies in the possibility of the inducement of a condition of paralysis. Such a condition is produced by the mature female tick and possibly also by the nymph, and apparently requires at least five days of attachment. The actual cause of this paralysis is unknown, but it is thought to be due to a toxin which is secreted in the salivary glands. Recovery may be possible providing the condition is not too far advanced and the ticks removed, but, generally speaking, once paralysis becomes evident the animal dies.

Control.

Scrub ticks appear to be abundant mainly during the spring months, and during these months short-interval dippings may be found advantageous when small flocks are concerned. The clearing of all scrub as far as practicable and the elimination of the marsupial hosts from the areas grazed by sheep is one of the first steps in the control of this tick.

Dipping.

Several good proprietary dips are on the market, the arsenical dips giving the best results. Sheep should be dipped as soon as they have

recovered from the shock and knocking about of shearing, and when the wool is long enough to hold the dip—say, about four to six weeks off shears. Since lice, keds, and ticks live on the skin surface and in the fleece, the infested animals need not be held in the dip longer than is necessary to wet the fleece and exposed surfaces. About one minute in the dip is usually considered long enough to wet the animals thoroughly. The heads of all the sheep should be pushed or ducked under the surface long enough to ensure complete wetting. Sheep should not be rushed through the dip.

The number of gallons required to charge a dip may be computed in the following manner:—Add together the length at the dip line and the length of the bottom and divide by two. This gives the average length. Obtain the average width in the same manner, and multiply the average length by the average width in inches and the product by the depth. Divide this by 231, and the result will be the approximate number of gallons required. As each sheep when freshly shorn will carry out about 2 quarts of dip, the quantity carried out and retained by the animals plus the quantity required to charge the dip will be a fair estimate of the total quantity of dip required.

Adverse conditions at the time of dipping can and do have a detrimental effect on the result. These are, however, sometimes beyond control, but by using a dip of unvarying and guaranteed consistency, good results will be obtained. The care and condition of sheep before and after dipping are matters which should not be overlooked.

Sheep should not be dipped during extremes of heat and cold, when thirsty, or when in a heated state from driving. They should be yarded overnight and dipped early next day, so that they may have abundant time to dry before nightfall. When ewes and sucking lambs have been dipped, the lambs should be kept apart for some time after dipping. Dipping on cloudy days is not advisable, as the sheep take a long time to dry and are exposed to the risk of rain, which would decrease the efficacy of the treatment to a large extent.

In conclusion, it may be pointed out that failure to maintain a flock free from external parasites in spite of regular dippings and spelling of yards, &c., may be due to (1) carelessness in mixing the dip; each maker supplies certain instructions with his dip which should be followed implicitly; (2) rushing the sheep through the dip so that each animal fails to get thoroughly wet; (3) failure to make a complete muster; (4) failure to ascertain whether sheep bought between dippings and mixed with the flock are clean or otherwise; and (5) the admission of strangers among the flock through broken boundary fences, &c.

Dip Formula.

Arsenic	2 lb.
Sodium carbonate (washing soda) ..	2 lb.
Water	100 gallons.

THE SHEEP BLOWFLIES.

Blowflies are generally regarded as species of flies which blow or lay their eggs on carrion, so, in the ordinary course of nature, acting as scavengers, and helping in this way to get rid of offensive materials in a rapid and efficient manner. Some of the species, however, have

developed the habit of utilising live flesh for this purpose. In the case of short-haired animals, such as cattle and horses, blowfly attack occurs only when wounds and abrasions are present to attract them; but in sheep, on the other hand, the soiling of the thick wool is in itself sufficient to attract the flies and induce "blowing." Wounds, of course, also play their part in the inducement of strike, the infestation of the flesh-cracks and bruises on the head of the ram caused through fighting, and of the tail of the lamb after marking, furnishing good examples.

The conditions predisposing sheep to blowfly attack are as yet imperfectly understood, but it is fairly evident that, before blowing will occur, the wool attracting the flies must have a certain degree of moistness. The crutch and pizzle wool, where fly attack is usually most general, is made attractive to the flies through soiling with excreta and urine. Wool made moist from dew and rain, and even from the saliva of the sheep when it has been biting at some irritation, may also be struck.

The Species of Blowflies Concerned.

In Australia twelve species of blowflies are recorded as attacking sheep, but only some of these are of importance in Queensland. These sheep blowflies belong to the super-family Muscoidea. *Sarcophaga froggatti* Taylor is a member of the sub-family Sarcophagidæ, or flesh flies, the majority of which breed in carrion, though some species infest excreta, and one is a useful parasite of grasshoppers. The Sarcophagidæ may be readily recognised by their striped thorax and checkered abdomen. *Sarcophaga froggatti* was originally obtained from wool-infesting maggots at Winton. A second species of sheep blowfly to be found in Queensland is known as *Peronia rostrata* R.D. This is a shining dark-blue fly belonging to the family Anthomyidæ. Flies of this family also breed in excreta and decaying vegetable matter. Little is known of the biology of *Peronia rostrata*, but it appears to have been bred only from sheep on which "blowing" was well advanced.

The remaining species belong to the sub-family Calliphorinæ, family Muscidæ, a family of flies of widely divergent habits, including, besides blowflies, such species as the house fly, stable fly, and buffalo fly. The Calliphorinæ are to be found breeding mainly in flesh. The six species of this sub-family attacking sheep in Queensland are *Lucilia cuprina* Weid., *Calliphora auger* Fabr., *Calliphora stygia* Fabr., *Chrysomyia rufifacies* Macq., *Chrysomyia micropogon* Bigot, and *Microcalliphora varipes* Macq.

Lucilia cuprina Weid.—This is a comparatively slender and bristly fly (Plate 137, fig. 4), about four-tenths of an inch in length. There is a fair amount of variation in size, which appears dependent upon the amount of food consumed by the larva or maggot. The colour is usually a bright metallic green, but varies to a certain extent, and at times may be almost uniformly bronzy, but it always shows a tinge of green and a characteristic metallic lustre.*

* There are two species of Lucilia concerned in strike—namely, *L. sericata* and *L. cuprina*, both of which were previously included under the one name, *L. sericata*. *L. cuprina* is the more important of these two species in Queensland, as *L. sericata* does not appear to extend further north than about Brisbane, and is unknown in the West. Both are introduced flies.

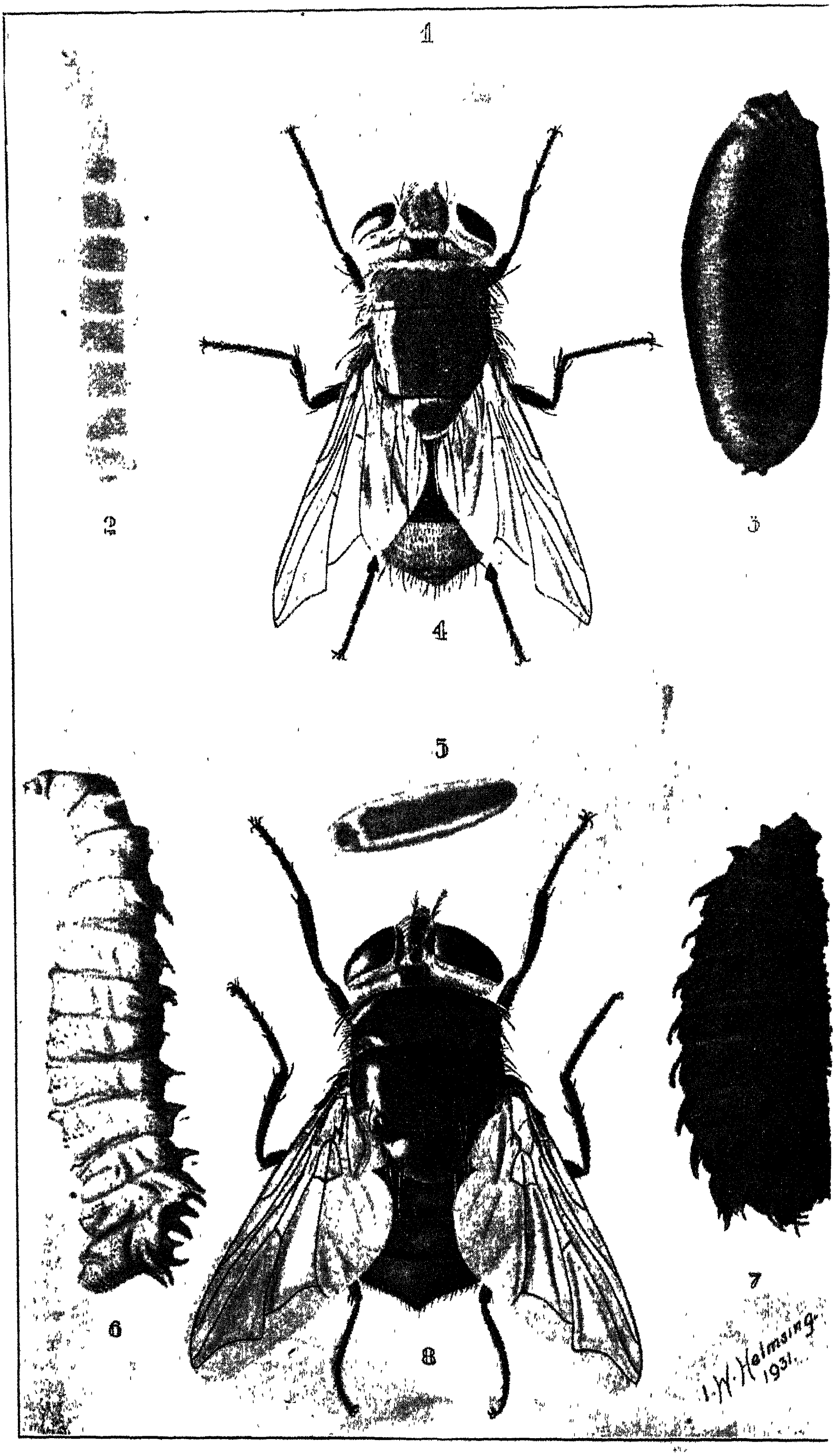


PLATE 137.—SHEEP MAGGOT FLIES.

Calliphora auger Fabr.—This is the smaller yellow blowfly which frequently comes into the house to blow meat. It may be readily recognised by the blue abdomen, deeply blotched on either side of the basal segments with yellow, so that the middle and apical portions of the abdomen are blue. The blue on the apical segments is somewhat obscured by a pale-yellow dust. The thorax is blue-grey, and the legs reddish-brown. This fly is a rather stout species measuring about one-third of an inch long.

Calliphora stygia Fabr.—This species is the larger yellow-bodied blowfly, which, like *C. auger,* frequents houses, and attracts attention by its persistent buzzing and boisterous flight. The insect is somewhat variable in size, but well-developed specimens may measure up to half an inch in length. The thorax is bluish-grey with a lighter under-surface, and yellow legs. The abdomen is greenish tinted, dusted with yellow, the whole of the upper surface clothed with short black hairs. The and yellow legs. The abdomen is greenish tinted, dusted with yellow, of the abdomen, give the fly a distinctly golden appearance. At least eight distinct species—all very similar in appearance to *C. stygia*—have been recognised, of which the Western Australian *C. australis* is one.

Chrysomyia rufifacies Macq.—This species is a comparatively robust fly (Plate 137, fig. 8), measuring about one-third of an inch in length. The colour is a uniform metallic blue, sometimes with a tinge of green, and sometimes bronzy like *Lucilia cuprina.* The colour is deeper on the edges of the abdominal segments to give the fly a distinctly banded appearance. If examined closely, very few bristles will be detected. *C. rufifacies* at times bears a strong resemblance to *Lucilia cuprina,* but may be readily recognised by its more robust appearance, prevailing bluish colour, the presence of the narrow bands across the abdomen, and the comparative lack of bristles. Both of these species may at times be confused with the greenish fly (*Pseudopyrellia* sp.) so frequently seen in large numbers around fresh cow dung. This species is not a blowfly, and its green colour soon turns to a bright blue-violet after death, while the colours of the two blowflies remain constant.

Chrysomyia micropogon Bigot.—In size *C. micropogon* approaches that of the smaller house blowfly, *C. auger.* It may be readily recognised by its large reddish-brown eyes, yellow face, uniform metallic dark-blue colour, and black legs.

Microcalliphora varipes Macq.—This is the smallest species of the blowflies infesting sheep, being about half the size of the house fly and

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SHEEP MAGGOT FLIES.

Description of Plate 137.

Lucilia cuprina Weid.

Fig. 1 .. .. Egg x 23.
Fig. 2 .. .. Larva x 7.
Fig. 3 .. .. Puparium x 7.
Fig. 4 .. .. Adult x 7.

Chrysomyia rufifacies Macq.

Fig. 5 .. .. Egg x 23.
Fig. 6 .. .. Larva x 7.
Fig. 7 .. .. Puparium x 7.
Fig. 8 .. .. Adult x 7.

somewhat more robust, due to its comparatively large head. Its colour is bright metallic green, with a pale-yellow face and mottled legs.

Life History Notes.

There seems to be no distinct strain of flies that attack sheep, for such flies that attack sheep will readily lay their eggs on meat, and, on the other hand, flies that have been reared on meat will oviposit on the wool of sheep. The period of development of the eggs and larvæ on the sheep is much the same as that in meat, and such of the life histories of Queensland sheep blowflies as are known have been for the most part obtained by rearing the larvæ in meat.

The life histories of the several species are very similar, differing only in detail. It is, therefore, proposed to deal thoroughly with the life history of only one species—*Lucilia cuprina*—mentioning that of the others only by way of comparison. This fly has been chosen, as it is probably the most important sheep blowfly, and has received a good deal of attention from various workers.

The Egg.

The female fly lays her eggs in some sheltered spot in the meat or in the wool. As many as 250 eggs (which are heaped together in a sticky mass) may be laid at one time. A single female, during her lifetime, may lay 1,000 eggs or more. The newly-laid egg (Plate 137, fig. 1) is white in colour, and somewhat sausage-shaped. In some of the species—*Calliphora auger* and *Calliphora stygia*—the egg at times is retained in the body of the female until it hatches, and is then deposited as a tiny maggot. In summer time the eggs may hatch within sixteen hours, but in midwinter may take as long as three days, or even more in a very cold climate.

The Larva.

From the egg comes the tiny, legless maggot of the fly. The maggot (Plate 137, fig. 2) is of an elongate conical shape, pointed at the anterior end and divided into a number of segments. The maggots of the majority of blowflies are smooth in appearance and whitish in colour, but those of *Chrysomyia rufifacies* (Plate 137, fig. 6) and *Microcalliphora varipes* are brown and so covered with erect tubercles as to give them a hairy appearance. In feeding, a slimy fluid is emitted from the mouth, and the wet and soiled appearance of infested wool is partly due to this fluid, which rots the wool fibres. They feed in squirming masses with the pointed head end immersed in the liquefied meat and their blunt hind ends raised above the surface. At this end there is a pair of openings, known as spiracles, through which the maggots breathe. The necessity of keeping these spiracles clear of the fluid is evident, else the maggots would perish.

In the warmer months the maggots feed rapidly, and are fully fed in four days. In the winter time they feed much more slowly, and may not be fully fed for seven days or more.

The Prepupa and Pupa.

When fully fed, the maggot crawls away from the meat or drops from the sheep, burrowing into the earth to seek protection from birds and parasites. Here it lies motionless for about two days in summer or for twenty-two days or more in winter, preparing for the commencement

of the great change in its life, from which it will emerge as the adult fly. This quiescent period is known as the prepupal or larval resting period. Gradually the maggot shrinks and its outer skin becomes hardened and turns brown. Inside this hard brown coat or puparium (Plate 137, fig. 3) the whole of the larval tissues break down into a creamy mass, from which the adult structures—the body, legs, and wings—are rebuilt. This is the pupal stage, and may last only six days in summer or as long as seventeen days or more in winter.

Duration of Life Cycle.

From the foregoing it will be seen that in summer time the life cycle of *Lucilia cuprina* may be completed in thirteen days and in winter in forty-nine days or more. For *Chrysomyia rufifacies* and *Microcalliphora varipes* the respective periods are nine and thirty-six days, and *Calliphora auger* seventeen and thirty-three days. The life-cycle periods of the remaining species are incomplete, but summer conditions are said to induce the emergence of the adult *Sarcophaga froggatti* in twenty-two days, and of *Chrysomyia micropogon* in twelve days. In the spring *Calliphora stygia* takes about thirty days for its life cycle, and *Peronia rostrata* twenty-six to forty-three days.

The life-cycle periods given above were obtained in Brisbane. It is probable that the western climate of Queensland would be conducive to a good deal of variation in the respective periods, especially in the winter, when the life cycle may extend over a period of several months.

The Adult.

The imprisoned fly, when ready to emerge from the pupa, is able, by means of a pulsating bladder-like organ on the front of its head, to push off the end of the puparium or hard pupal case and work its way to the surface of the soil.

On emerging the fly is very soft and drab in colour. It makes its way to some sunny spot, where it spreads its wings and raises them up and down to facilitate drying. After a while the bladder is withdrawn into the head, the body and wings dry, the colours of the body become evident, and the insect (Plate 137, fig. 4) is ready to fly off and commence its adult life.

Little has been published of the biology of the adult flies, but certain data concerning their range of flight and longevity is available.

It has been shown that the range of flight of the blowfly *Chrysomyia rufifacies* is at least 10 miles, which can be traversed in about twelve days. This means that flies breeding in a carcase may be distributed over a tract of country 20 miles in diameter—an area of 314 square miles. The flight of the flies is usually with or slightly across the wind, but carrion may be followed against a slight breeze.

The length of life of the adult or fly stage of *Chrysomyia rufifacies* in the field has been determined as at least twenty-eight days. Under conditions of captivity, *Lucilia sericata,* which is very similar to *Lucilia cuprina,* has been kept alive for seventy-seven to ninety-one days.

Why "Strike" in Sheep Occurs.

Various theories have been advanced to explain blowfly infestation of sheep, but the modern viewpoint indicates two factors as being mainly

concerned. First of all, although there are several species of blowflies which attack the sheep, many of these may be present without "strike" being evident. Observations have shown that the sheep blowflies may be divided into two groups mainly according to the manner in which they react to carrion. If an animal dies certain species are immediately attracted to the carcase and lay their eggs. These flies are induced to oviposit only while the flesh remains comparatively fresh. Once it has reached a certain stage of decay it is no longer attractive to them. After the maggots of these flies have been at work for some time the carcase is then rendered suitable for oviposition by other species of flies. Thus the carrion-feeding blowflies become divided into *primary* and *secondary* flies, the primary flies including those species which visit the carcase first and are only attracted while the flesh remains comparatively fresh. Moreover, infestation of carrion by the maggots of the primary flies is considered to be necessary before the secondary flies can be induced to oviposit. That is, the primary flies' maggots, in some way or other, render the carrion suitable as food for the maggots of the secondary flies. In the total absence of these primary flies the carrion may not be infested with blowfly maggots to any marked extent, and may simply dry up. *Lucilia cuprina* and the two species of *Calliphora* are primary flies, whilst *Chrysomyia rufifacies* and *Microcalliphora varipes* are secondary flies.

In the case of blowing of sheep these two groups of flies play a similar part to that enacted with carrion. Strike is initiated usually only by the species of *Lucilia* and *Calliphora*, and previous infestation with the maggots of these flies is necessary before the hairy maggots of *Chrysomyia rufifacies* and *Microcalliphora* are seen. The position with regard to *Chrysomyia micropogon* is not known to any degree of certainty. It is believed that this fly is secondary to a certain extent, but that in the presence of wounds and abrasions which have reached a certain stage of decay its maggots are able to exist without the previous presence of maggots of the primary flies. In most cases, however, strike can be initiated only by the primary flies, and in their absence very little blowing of sheep would be evident.

The second factor necessary to induce strike is that not only is the presence of a species of one of the primary blowflies required, but the sheep must be attractive to the flies to an extent sufficient to induce them to lay their eggs. The parts of the body most favourable to the flies, not taking into account the presence of wounds, are the crutch and adjacent areas in ewes, around the pizzle in wethers and rams, and occasionally the shoulders and other parts of the body which, under certain conditions, are kept moist. It is now considered that this attractiveness to the flies is associated with bacteria which are present in the fleece and on the skin surface, and which under certain conditions, of which the presence of moisture is probably the most important, increase and render the sheep attractive to the flies. Heavily-wrinkled sheep are especially attractive, for the body folds, by retaining the body secretions and any moisture, are areas in which these bacteria develop and increase very rapidly. Strike on portions of the body such as the shoulders and back are associated with a condition of the fleece known as "water rot," which is caused by certain bacteria in the presence of constant dampness.

Control of Sheep Blowflies.

Trapping and carcase treatment have in the past been given greatest prominence as measures to be adopted for blowfly control.

Trapping.—To be successful the majority of flies caught by trapping should be primary flies. Unfortunately, however, most of the flies trapped are secondary, due to the fact that primary flies are only attracted to the bait whilst it remains comparatively fresh. Little result can therefore be expected from trapping unless a bait can be discovered which will remain attractive to the primary flies over a comparatively long period.

Carcase Treatment.—Carcase treatment is necessary from a sanitation standpoint, but it is questionable whether it has any influence towards the control of strike. Some slight control by carcase treatment may be expected only if the carcase is treated within about three to four days of death. This would kill the maggots of the primary flies breeding there, but if the treatment is delayed any longer than about three or four days these maggots will no longer be present, and those destroyed will be the progeny of the secondary flies; in which case such delayed treatment may do more harm than good so far as the control of strike is concerned. It has already been pointed out that the primary flies visit the carcase first and their maggots are at work shortly after death. The carcase is then invaded by the secondary flies whose maggots not only render the flesh unsuitable for the primary fly maggots, but, being more robust, are more successful in the competition for the available food. As a result a good percentage of the primary fly maggots are driven from the carcase and die. Thus it will be seen that these secondary flies act as a control on the numbers of primary flies, and a wholesale destruction of their maggots might possibly result in an increase in the numbers of the primary flies upon which initiation of strike depends to a large extent.

Carcases are best treated by burning or by the careful application of a poison dip powder containing arsenic to all portions. The part of the carcase in contact with the ground must receive special attention.

Jetting.—Jetting will give immunity from "strike" for a period of four to six weeks. The following formula was found by the Department of Agriculture, New South Wales, to be more satisfactory than any other that was used:—

White arsenic	10 lb.
Stone lime	10 lb.
Caustic soda	1 lb.
Water	100 gallons.

The pressure used should not exceed 150 lb. to the square inch, otherwise the skin may be injured.

Dressings.—There is no dressing yet known which may be regarded as entirely satisfactory, but the following are recommended:—

(1) ½-1 oz. Paris green, 6-8 oz. Kaolin, 18 oz. soft soap solution (·5 per cent. strength).

(2) Five per cent. watery solution of zinc sulphate.

(3) Four per cent. phenol crystals in whale oil.

(4) Five per cent. watery solution of Monsol.

INTERNAL PARASITES.

The internal parasites of the sheep comprise tapeworms, a fluke, several species of roundworms, and one other form, the nasal fly.

THE SHEEP NASAL FLY (*Oestrus ovis* L.) (Fig. 1 (a) and (b)).

Description and Life History.

The adult sheep nasal fly (fig. 1 (*a*)) is a squat greyish fly which appears during the spring and summer months. The fly deposits a tiny grub on the edges of the nostril which makes its way up the nostril and sometimes into the communicating cavities. The presence of the fly often causes the sheep to become frantic in their efforts to prevent the fly attacking them, and they generally hold the nose against the ground or some other sheep when the fly is about.

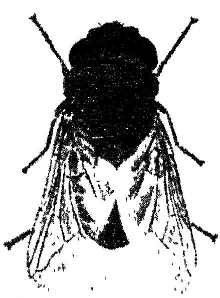


FIG. 1 (*a*).

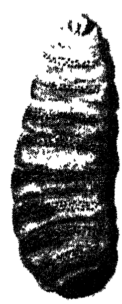


FIG. 1 (*b*).

PLATE 138.

The larvæ or grubs (fig. 1 (*b*)) are provided with a strong pair of mouth hooks and the body is encircled with rows of spines. By means of these mouth hooks the larva maintains its position in the nostrils feeding upon the discharges its presence occasions. When fully grown the larva measures up to four-fifths of an inch in length, and is yellowish in colour with black bands on the dorsal surface. It then leaves the nostril, usually being sneezed out by the sheep, and upon reaching the ground burrows below the surface and pupates. The outer skin hardens, becomes leathery, and turns black. From the pupa the adult fly eventually emerges.

Effect on the Sheep.

The presence of the grubs in the nostril produces an irritation resulting in a discharge which becomes thickened and discoloured, presenting the condition known as "snotty nose." The animal frequently sneezes and in heavy infestations its breathing may be seriously interfered with. The eyes may become inflamed and the sheep may continually move its head about as though endeavouring to rid itself of the obstructions in the nostrils. The appetite is impaired and the animal may lose condition. Death due to nasal fly is not very common, but the grubs have been seen in the brain.

Control.

Treatment is not very satisfactory and control depends almost entirely on preventive measures. The best of these consists in boring small holes about 2 inches in diameter in the bottom of the salt troughs. Salt is placed in these holes, the edges being heavily tarred with pine or Stockholm tar so that the sheep get the tar on their nostrils as they lick the salt. The tar acts as a repellent and prevents the fly depositing larvæ in the nostrils.

TAPEWORMS.

Two larval tapeworms occur in the sheep—the bladder worm, *Cysticercus tenuicollis,* and the hydatid worm, *Echinococcus granulosus. Cysticercus tenuicollis* is the bladder worm so frequently encountered in the body cavity of the sheep. It is sometimes also seen in the liver. The adult tapeworm, known as *Taenia hydatigena,* occurs in the dog, which becomes infested only when it eats a portion of the sheep containing a bladder worm.

PLATE 139.

FIG. 2. TAPEWORM (*Moniezia expansa*). Natural size.

The hydatid larva, *Echinococcus granulosus*, is usually found in the liver and lungs. The adult tapeworm also occurs in the dog, the life history being similar to that of *Taenia hydatigena*.

Of these two larval tapeworms, the most important is the hydatid worm, as it may also occur in man. Prevention consists in not feeding raw offal to dogs, as this may contain the larval forms. Dogs should also be kept as free of the adult tapeworms as possible by treatment with an efficient drug.

Adult tapeworms are found in the small intestine of the sheep, more especially in lambs. Two species are known to occur in Queensland—*Moniezia expansa* (Fig. 2), which is very common, and *Halictometra giardi*, which is much less frequently seen. Both these species are whitish to yellowish in colour and may attain a length of many feet, *Moniezia expansa* (fig. 2), which is very common, and *Halictometra* of both these species are unknown, and preventive measures cannot therefore be outlined. Lambs infested with tapeworms become unthrifty, weak, and emaciated, diarrhœa being frequently manifested. Diagnosis is readily made by examining the fæces in which tapeworm segments will be seen.

Treatment consists in starving overnight, and next morning each lamb is given 1 to 1½ fluid ounces of the following formula:—

White arsenic (containing not less than 95 per cent. arsenious acid)	2 oz.
Epsom salts	6 lb.
Water	5 gals.

Boil the arsenic for half an hour in two gallons of water; allow to cool and sediment. Pour off and retain the clear liquid; add the Epsom salts, and make up to 5 gallons.

FLUKE.

Only one species of fluke occurs in the sheep in Australia—namely, the liver fluke, *Fasciola hepatica*. This parasite is found in the bile

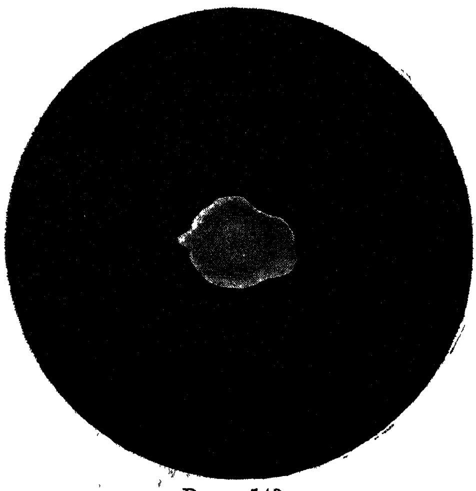


PLATE 140.

FIG. 3. THE LIVER FLUKE (*Fasciola hepatica*). Natural size.

ducts of the liver, and in the Southern States is a serious parasite. Although it is found in one or two districts in Queensland, it is only of minor importance in this State.

THE LARGE STOMACH WORM.

PLATE 141.
FIG. 4. THE LARGE STOMACH WORM (*Haemonchus contortus*). Natural size.

Description.

This worm is found in the fourth stomach, and is undoubtedly the most serious parasite the Queensland sheepman has to contend with. The appearance of the parasite is very distinctive, as the female is spirally striped, resembling in general a barber's pole. The male is smaller and uniformly whitish or pinkish.

Life History.

The eggs laid by the female worms pass out in the dung, and under favourable conditions of temperature and moisture hatch in a few hours. The young larva, on emerging from the egg, feeds in the dung, and during its development casts its skin twice. After the second moult, however, the cast skin remains as a closely-fitting sheath and assists in protecting the larva against such adverse conditions as dryness. This ensheathed larva is the infective stage, and it is only by swallowing the ensheathed larva that the sheep can become infested. When the grass is wet with dew or rain this larva crawls up the grass blades and is eventually consumed by the sheep as it grazes. In the fourth stomach the tiny worms grow rapidly, and after about four weeks are fully mature and laying eggs.

Effect on the Sheep.

Stomach worm infestation is serious, and if left untreated, heavy mortalities may occur. Such symptoms as periodic scouring, bleaching of the skin and mucous membranes of the eyes and mouth, bottle jaw, tucked-up flanks, and a rapid loss of condition accompany infestation with this round worm. Stomach worm is most serious among lambs, especially weaners, and lambing ewes.

Treatment and Control.

For the removal of the large stomach worm, carbon tetrachloride or bluestone is highly efficient. Carbon tetrachloride is given in doses of 2 cubic centimetres for adults and 1 cubic centimetre for lambs in 3 and 4 cubic centimetres respectively of liquid paraffin. This drug is regarded as being more efficient than bluestone, and much easier to administer, as the dose is very small and does not require, moreover, previous starvation. In certain classes of country and under certain conditions not yet quite understood, however, sheep may not tolerate this drug, and even a very small dose may have serious and even fatal results. It is essential, therefore, that where carbon tetrachloride has never previously been used, that only a few sheep be treated at first and the effects of its use carefully noted. Frequently this intolerance is due to a calcium deficiency, and sheep running on country deficient in this element should be given a calcium lick for some time before treatment.

On the whole, bluestone may be regarded as a safer drench than carbon tetrachloride, though not so effective nor so easy to administer. It may be given alone or with an equal quantity of mustard. The addition of the mustard is considered to increase the efficiency of the treatment, but at the same time, it must be pointed out, considerably adds to the cost as well. Starvation overnight is necessary, and should be continued for about four hours after drenching. Only fresh (blue) bluestone should be used, and any white powdery material should be discarded. The bluestone should be mixed in an enamel or earthenware vessel, so that it cannot react with a metal surface, which would decrease its effectiveness.

Formula.

Bluestone	1 lb.
(Mustard)	(1 lb.)
Water	5 gals.

Dose.

Adults	2 fluid oz.
Lambs	1 fluid oz.

On holdings which are heavily infested, only treatment at regular intervals will hold the worms in check. During the summer months, treatment at monthly intervals is essential, especially towards the autumn. At least one drench is desirable about midwinter and another at the end of the winter, about September.

As the lambs and lambing ewes are usually most seriously affected by infestation, any control measures that are considered practicable should especially concern these two classes of sheep.

Marshy areas and other low-lying paddocks should, if possible, be used for the older sheep, wethers and aged ewes.

Burning-off the pastures will destroy a big percentage of the free living stages in the grass. Such burnt-off paddocks are comparatively safe for young sheep which, however, should be drenched before being placed there. It is a good idea to reserve such a paddock for the use of the weaners only, which, of course, must be drenched just before they are taken from the ewes. Heavy stocking makes stomach worm control very difficult, and on heavily infested holdings it is advisable to go to the other extreme and under-stock until there is some definite degree of

control obtained. In cases where paddocks can be left vacant, no sheep or cattle should be allowed to graze for at least six months, and at the end of this period such paddocks may be considered safe for stocking with clean sheep.

Finally, the provision of suitable licks and, where possible, the top-dressing of pastures, should be given consideration, as the improved health of the sheep resulting from these practices enables it to resist the effects of infestation to a conspicuous extent.

LESSER STOMACH WORM.

PLATE 142.
FIG. 5. THE LESSER STOMACH WORM (*Ostertagia circumcincta*). Natural size.

Besides *Haemonchus contortus*, the fourth stomach may be inhabited by a smaller brownish species, *Ostertagia circumcincta*, which lies just under the mucous lining. This parasite, though fairly common, does not occur in large numbers and is not considered to be of any economic importance in Queensland. The life history is similar to that of the large stomach worm.

SMALL TRICHOSTRONGYLES.

Description.

These are very tiny, hair-like worms, reddish in colour, occurring mainly in the first 15 to 20 feet of the small intestine. Their size makes them easily overlooked, and detection is only possible by a very careful examination of the intestine wall. They may be responsible for serious losses among lambs and are concerned with a diarrhœric condition known as " black scours." Their life history is practically the same as that of the large stomach worm.

Control.

In South Africa these worms are commonly known as "bankrupt worms" and are very aptly named. At present there is no drug which is efficient in removing them, though regular drenching with carbon

tetrachloride or bluestone may have some beneficial effect. These parasites, for the main part, affect only the lambs, and everything possible should be done to prevent the young sheep from becoming infested.

PLATE 143.
FIG. 6. SMALL TRICHOSTRONGYLES (*Trichostrongylus spp.*). Natural size.

The preventive measures recommended for the large stomach worm should be practised. In addition, the use of improved pastures, especially for the lambs, is of the greatest importance if breeding in areas where the small *Trichostrongyles* are present is to be continued.

THE NODULE WORM.

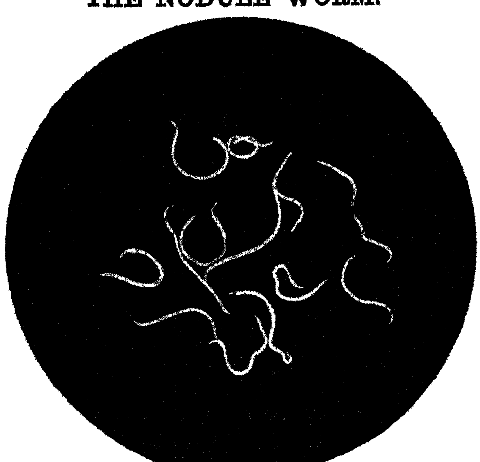


PLATE 144.
FIG. 7. THE NODULE WORM (*Oesophagostomum columbianum*). Natural size.

Description.

Of the species of roundworms that infest the intestinal tract, one of the most important is the nodule worm which is found in the large bowel. The adult worms are whitish in appearance, with the head end bent in the shape of a hook. The females may attain a length of five-eighths of an inch, the males being somewhat smaller.

Life History.

The life history in the dung results, as in the case of the large stomach worm, in an infective ensheathed larva which is taken in by the sheep whilst grazing. The larva eventually reaches the large bowel and burrows into the wall of the intestine. A nodule is formed around the larva, in which it lies for a minimum period of six to eight days. Leaving the nodule, the young worm moves into the lumen of the intestine and develops into an adult. Larvæ can be found only in the very small nodules, which in time increase considerably in size, and become filled with a hard, cheesy, greenish pus.

Effect on the Sheep.

A heavy infestation produces emaciation, general debility, and frequently continuous scouring. Young sheep are more affected, and in country showing nodule worm remain stunted and unthrifty.

Control.

Up to the present no satisfactory treatment for the disease associated with this worm is known, and the preventive measures already discussed for stomach worm are of the greatest importance.

THE WHIPWORM.

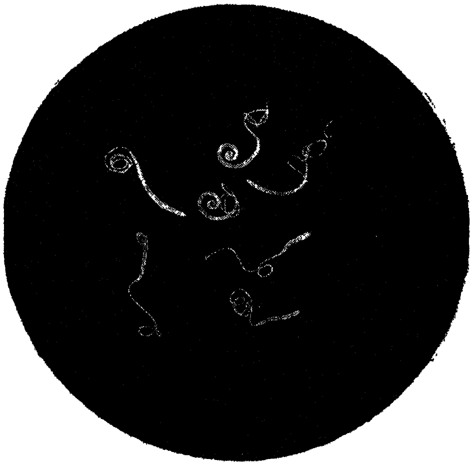


PLATE 145.
FIG. 8. THE WHIP WORM (*Trichuris ovis*). Natural size.

Description.

Whipworms, *Trichuris ovis,* occur in the cæcum or blind gut and in the adjoining portion of the large intestine. The species may be readily recognised by its whip-like appearance, the lash being represented by the long, slender anterior part of the worm, while the thick posterior portion of the body is reminiscent of the whip handle.

Life History.

The eggs passed out in the dung develop into infective embryos, which, on being swallowed by the sheep, hatch and give rise to tiny larvæ. These larvæ make their way to the cæcum, where they grow to maturity.

Effect on the Sheep and Control.

Unless present in very great numbers, which is extremely rare, this species is not associated with any pathogenic condition. No satisfactory treatment is known, and the worms can be controlled only by preventive measures.

LUNGWORMS.

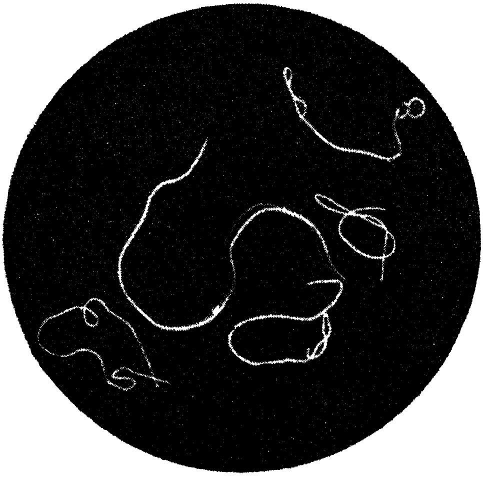


PLATE 146.
FIG. 9. THE LARGE LUNGWORM (*Dictyocaulus filaria*). Natural size.

Description.

There are three species of lungworms infesting sheep, but the only species of any importance in Queensland is the large lungworm, *Dictyocaulus filaria*. These are long whitish worms up to 3 inches or more in length, occurring in the air tubes of the lungs.

Life History.

The eggs, when laid by the female worm, contain a small active larva which hatches either in the lungs or in the alimentary canal. They are passed out mainly in the dung, but may also be coughed up or appear in the nasal secretions. In the open the larvæ, under suitable conditions of temperature and moisture, become infective, and are eventually swallowed by the sheep when grazing or drinking. They eventually reach the lungs either in the blood or lymph stream, settle down in the air tubes, and grow to maturity.

Effect on the Sheep.

A few lungworms do little harm, but when a heavy infestation is present the worms irritate the lung tissue, causing severe inflammation and the production of a frothy mucus. The bunches of worms obstruct the passage of air, and the animals show symptoms of difficult breathing. A frequent husky cough becomes evident, and the infested sheep may rapidly lose condition and die.

Control.

The following recommendations are given for the control of this parasite:—

(1) The greatest sources of infestation are pools of water and low-lying, marshy areas, and these should be avoided as sheep pastures in lungworm areas. In the case of an outbreak, any sheep in pastures of this nature should be immediately removed to a dry, well-drained, and sheltered paddock.

(2) Treatment with carbon tetrachloride or bluestone is advised. This has no effect on the lungworms themselves, but as lungworm and stomach worm infestations usually occur together, this treatment, by removing the stomach worms, increases the sheep's resistance to lungworm.

(3) It has been shown experimentally that infested sheep recover more rapidly by good nursing than by any other attempted treatment. Provide a good, safe water supply in troughing. See that the paddock is well shaded and sheltered, and supplement the grazing of the affected sheep with hand-feeding and suitable licks.

(4) Injection of certain drugs into the windpipe by means of a sterilised hypodermic syringe will give relief. The operation is not an easy one, however, and should be carried out under the supervision of the local stock inspector. The following formula will be found satisfactory, especially if three treatments are given at three-day intervals:—

Oil of turpentine	1 c.c.
Creosote	0·5 c.c.
Olive oil	2 c.c.
Chloroform	0·5 c.c.

A WIRE GATE.

There will be no difficulty in constructing this gate, which is an improvement on the "concertina" type.

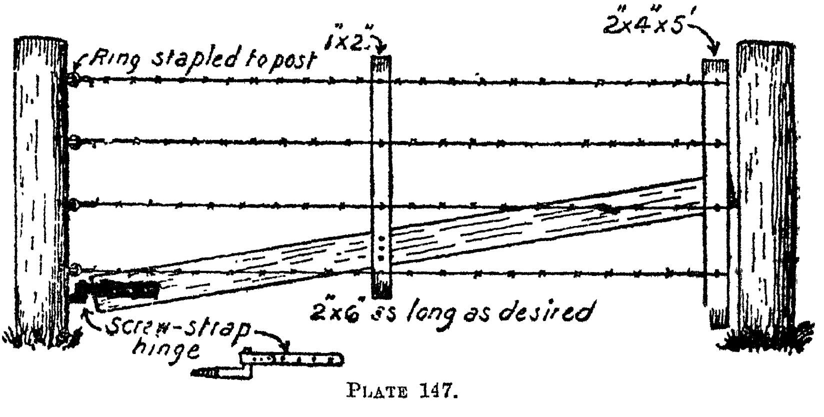


PLATE 147.

Queensland Weeds.

By C. T. WHITE, Government Botanist.

NUT GRASS (*Cyperus rotundus*).

Description.—A grass-like plant producing numerous underground runners and tubers. The tubers globose or egg-shaped, mostly about ½-inch long, covered with a dark brown skin. They possess a white or cream-coloured flesh with a rather nutty, somewhat aromatic flavour. Leaves green, 4-6 inches long, the lowermost ones clothing the bottom of the shoot reduced to reddish brown sheathing bracts. Seed heads radiating and branching from the top of a green triangular stem 6 inches to a foot or more high, and subtended by three narrow leaves. Seed heads composed of a number of reddish-brown many-flowered spikelets. Seeds or nutlets chestnut brown, but apparently rarely if ever ripen in Queensland plants.

Distribution.—Nut Grass is a widely spread tropical and subtropical weed, and as it was collected in North Australia by Robert Brown in the very early years of the nineteenth century, it is reasonable to suppose that it is a native of Australia in common with other warm countries.

Botanical Name.—*Cyperus*—origin obscure, perhaps from Cypris, a name of Venus from the edible tubers of some species being supposed to have marked qualities as an aphrodisiac; *rotundus* (Latin) meaning round, referring to the globose tubers.

Properties.—Nut Grass has some value as a fodder and is readily eaten by all classes of stock. Pigs are especially fond of the tubers and on this account the practice of pasturing them on Nut Grass-infested areas is often adopted.

Eradication.—On the whole it may be stated that both in Queensland and in other countries poisonous sprays have proved of little or no value unless several applications are made. Experience has shown, however, that small patches can be eradicated by an application of cheap-grade salt at the rate of ¼ lb. per square foot, either dry or in the form of brine. Waste brine as obtainable from butchers, hide stores, &c., is quite suitable. Heavy applications of this type, however, render the land unfit for cultivation for a season, but the method is excellent for tennis courts, wide garden paths, &c., where the salt can do no harm. The best results are obtainable by applying the salt in hot, dry weather. In small areas one of the best methods of eradication is to keep the green growth constantly cut off, and this on the whole seems better than forking the land over. The Nut Grass tuber is a storehouse of nutriment for the young shoots. The food material stored in the tuber is used in the formation of the young shoots. Cut these off regularly and the tuber will eventually become exhausted. Another point is that the formation of fresh tubers is dependent upon the leaves, and if these are not allowed to grow fresh tubers cannot be formed and the old ones must die of exhaustion.

It has been recommended at odd times that small patches should be covered with galvanised iron or some such material, but this is of no value whatever as the Nut Grass tubers simply remain dormant, and spring into active life as soon as the covering is removed. Pigs and

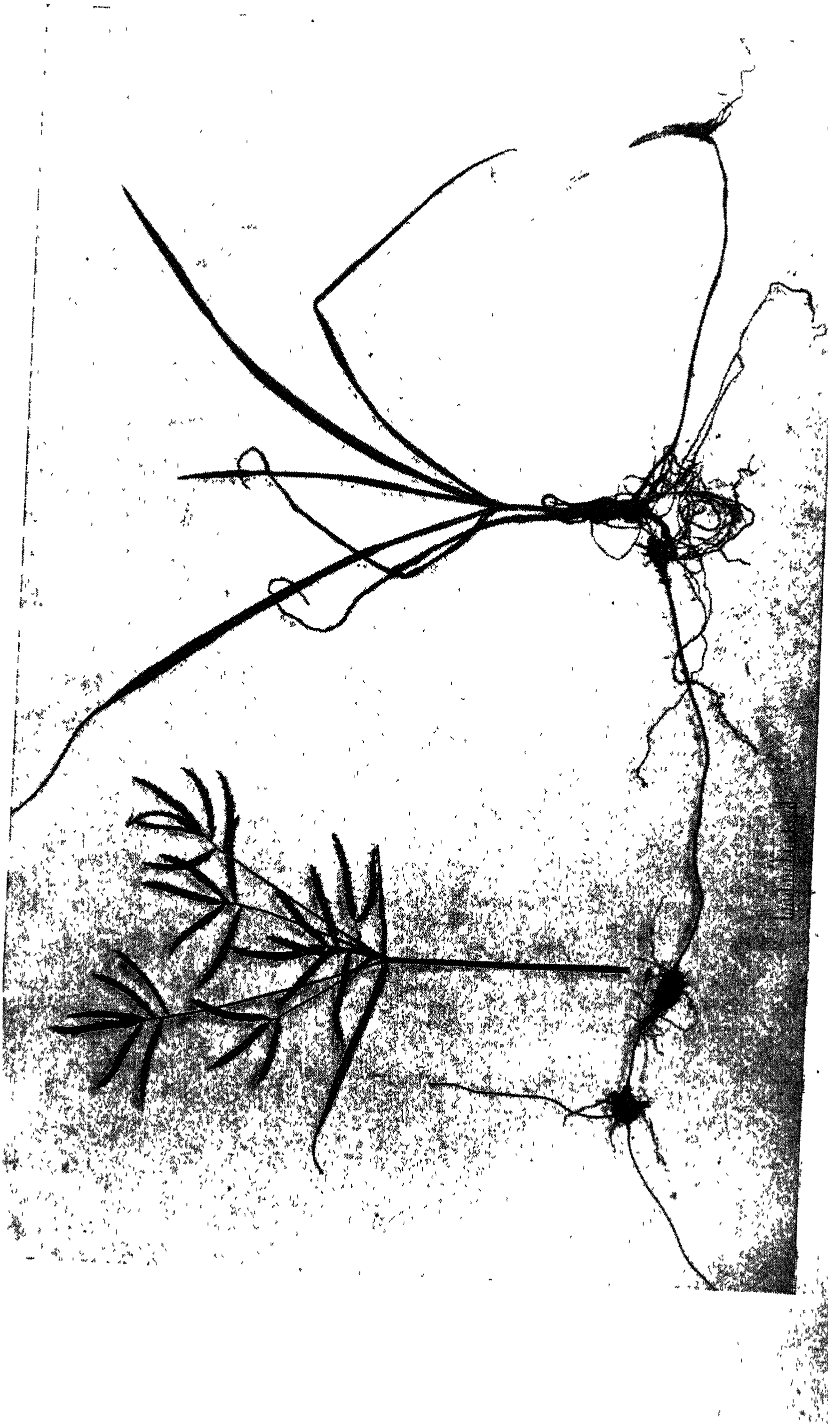


PLATE 148. NUT GRASS (*Cyperus rotundus*).

poultry, including ducks, do good work in keeping the weed in check in small areas, and in confined places will in a few years completely eradicate it.

A great deal of hope has been raised at times of insects having considerable possibilities in the control of Nut Grass. An article on a Coccid (the family to which the scale insects belong) and a Mealy Bug was published by Mr. W. A. T. Summerville in the "Queensland Agricultural Journal" for October, 1933. After consideration of evidence gathered from time to time and from different localities, it is stated that either insect has little or no value in controlling Nut Grass in such places where Nut Grass would ever become a pest to the farmer.

Botanical Reference.—Cyperus rotundus Linnæus species Plantarum 45, 1753.

SOUR GRASS OR YELLOW GRASS (*Paspalum conjuqatum*).

Description.—An extensively creeping grass covering large areas to the exclusion of other herbage. Leaves mostly about 5 inches long and ½ inch broad. Seed heads usually two at the top of a slender stem and spreading away from one another; very slender, 3-4½ inches long, with the small, rounded, yellow spikelets ("seeds") crowded in two rows on one side of each branch of the two seed heads. Individual spikelets ("seeds") round or slightly depressed on one side, convex on the other, and enclosing a shining, semi-translucent, straw-coloured grain; margins of the spikelet thickened and bearing a few long hairs.

Distribution.—A widely spread grass over the tropical regions of the world; originally described from Dutch Guiana, tropical South America.

Botanical Name.—Paspalum from *paspalos,* one of the ancient Greek names for the Millet; *conjugatum* (Latin), meaning coupled or united and relating to the two branches of the seed head.

Common Name.—In North Queensland generally known as Sour Grass or Yellow Grass. In the Hawaiian Islands, where it is also a weed, it goes under the name of Hilo Grass. In the West Indies it is known as Sour Grass.

Properties.—Wherever this grass grows it is looked upon as worthless as a fodder. It is a common weed under rubber trees in Papuan plantations and I have seen working mules eat it and in conjunction with other feed do quite well on it; no doubt they were driven to it by the absence of other green grasses and herbage. The grass has occasioned some concern in the wetter parts of the Atherton Tableland, due to its invading dairying pastures to the exclusion of Paspalum and other good grasses, rendering the pasture practically useless for milk production.

Control.—The only method of control that suggests itself is ploughing out and replanting with some smothering grass such as Giant Couch (*Brachiaria mutica*), Kikuyu or similar kinds, and spelling the paddocks so as to give the better grasses a chance to establish themselves in spite of the competition of the Sour Grass.

Botanical Reference.—Paspalum conjugatum, Bergius, Act. Helv. Phys. Math. 7, 129, 1762.

Plate 149. Sour Grass or Yellow Grass (*Paspalum conjugatum*).

Cotton Varietal Testing.

By W. G. WELLS, Director of Cotton Culture.

THE introduction of the system whereby the Commonwealth Government bounty will be on lint cotton rather than on the unginned seed cotton will probably necessitate a change over to the method of paying the growers for their lint rather than for the seed cotton they send in, which has been the basis used since the commencement of the present phase of cotton-growing in this State.

On account of this, many farmers will probably want to try out several varieties, especially some of the big-boll, high-lint percentage types, to see if they can increase their yields of lint per acre. The following descriptions of methods of testing varieties have therefore been written to acquaint growers with some of the precautions which have to be taken to insure that results of reliable value are obtained from varietal trials.

It is pointed out, however, that varietal testing, if carried out properly, is a more difficult procedure than most growers realise. Frequently requests are received for an allotment of several varieties so that a test can be made of their comparative suitability, and quantities of seed sufficient to plant as much as five or more acres of each are ordered, with the idea of planting single areas of each. It is advised, however, that yields obtained from only one plot of each variety do not present reliable evidence of their merits. It is very probable that in such single-plot tests, if the position of the varieties had been otherwise, entirely different results would have been obtained, unless, of course, varieties of decided differences in yielding ability were being tried.

Investigators of agricultural problems throughout the world have long recognised the dangers connected with judging the merits of varieties by results obtained from only one plot of each, and methods have been devised to eliminate as many influences as possible that might affect the validity of the conclusions drawn from an experiment. Mathematicians have clearly demonstrated that increasing the number of plots of each variety in a test, undoubtedly allows of a much better gauging of the merits of each one. In recent years marked progress has been made in improving the technique of varietal testing, particularly in regard to the estimation of the reliability of the results obtained. These methods have been used here in cotton investigations for some years, and have been found highly suitable for the conditions. Growers should, therefore, use them more extensively than is the case at present.

If a test consists of only one plot of each variety, the question arises as to how the yields are affected by the position of the plots. If the rows are planted across a slope, which is the correct way to help reduce soil erosion, the varieties in the top or bottom plots may have decided advantages or disadvantages, according to the seasonal conditions. In a dry season the bottom acre plot will have the advantage of the soakage from the rest of the experiment, and obviously the variety grown on it might yield outstandingly better than any of the others, whereas in reality it might actually have considerably less yielding ability when under comparable conditions. If several plots of each variety are grown, however, a much better sampling of the soil can be

obtained, provided the same order of location of each variety is not followed each time, such as ABCD, ABCD, ABCD. Obviously if the same order is used each time variety D will have the advantage or disadvantage in each group of comparisons, for it will always be on the low side of the others.

Latin Squares.

A method has been devised wherein as many plots of each variety are planted as there are varieties in the test, and the positions of the plots are such as to subject each variety to approximately the same soil influences. This plan is called a Latin Square, and for testing from four to six varieties it appears to be well suited to Queensland conditions. In such an experiment four rows of a variety are planted in a plot, with the plots arranged in one long face and the rows running across the field. This allows of the using of a two-row planter, for the one round trip plants a plot. By measuring off the width of the experiment and tagging the location of each plot of a variety with rags of the one colour, all the plots of one variety can be planted, then all the different tagged plots of another, &c., the experiment requiring only a small amount of extra work over regular commercial planting. At harvesting time the whole row may be picked for the experiment, or a section taken from across all plots on uniform average soil, where the most regular stand can be obtained.

The following experiment illustrates how four varieties are located—the data being from an actual test carried out in the 1933-34 season:—

PLAN I.

Block.	1				2				3				4			
Plot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of Rows ..	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Variety	A	B	C	D	B	D	A	C	D	C	B	A	C	A	D	B
Yield lb. s/c.	35	31	35	43	25	49	44	42	41	35	26	48	36	35	34	26
Block Yield	144				160				148				131			
Block Yield on a per acre rate	1,162 lb. s/c.				1,291 lb.				1,194 lb.				1,057 lb.			

There were four rows in each plot of each variety, but only the cotton from the two middle rows of each plot was weighed, for it has been found that the first and last rows of a plot may be influenced decidedly by the adjacent variety. That is, if a tall rank growing variety is grown alongside of one of a smaller structure, the outside rows of both varieties may not give truly representative yields, hence in varietal testing the yields of the outside rows are not included in the results analysed.

It will be noted that although each variety occurs only once in each block of four plots in the experiment, there is a marked difference in

the block yields—Block 2 yielding at the rate of 1,291 lb. seed cotton per acre, whereas Block 4 yielded only at the rate of 1,057 lb. This shows clearly the variation in soil fertility that can exist in an experiment, and had only one variety been planted in each block, most misleading conclusions might have been drawn as to their merits. It is quite possible that B, the low-yielding variety, might have been planted by chance on the highest yielding block, if only one variety had been sown in each one. The superior yielding ability of the best block would therefore have given the low-producing cotton an advantage over the others, and thus might have put it in the lead, whereas in reality with a repetition of several plots, it was shown to be decidedly the lowest yielder.

If the plot yields of the included test are grouped as in Table I., the variation in plot yield within the one variety is shown—yet it will be noted that variety B is consistently lower than any of the other varieties in each block. The results are obviously of much more value, therefore, for this variety has yielded the lowest in all four comparisons, whereas if only one block of each variety had been planted this variety might have been in the lead.

TABLE I.

PLOT YIELDS OF EACH VARIETY (2 INNER ROWS $= \frac{1}{32 \cdot 27}$ of an acre.)

A	B	C	D
35	31	35	43
44	25	42	49
48	26	33	41
35	26	36	34
*40·5	*27	*36·5	*41·75

* Mean yield in lb. of seed cotton.

It can thus be seen that it is necessary to have several plots of each variety in order to obtain a thoroughly representative sampling of the soil on which the experiment is being conducted.

Lint Yields.

It has been shown how necessary it is to have accurately determined results before the yielding ability of a variety, in terms of seed cotton per acre, can be determined. With the payment of the bounty on lint cotton, it becomes all the more imperative to ascertain the true yielding ability of a variety, for the main varieties being grown in Queensland range from slightly over 32 per cent. lint up to 40 per cent. under average conditions. On some soils a variety producing 39 per cent. lint may yield less seed cotton than a low lint per cent. variety, and yet the amount of lint produced, due to the higher lint percentage, may make the former variety a more valuable one to the grower. It does not follow, however, that a variety with a high lint percentage will always produce more lint or greater monetary returns per acre

than will a variety with a low lint percentage. This is amply demonstrated in the experiment that has been used to illustrate the points made in this article, as is shown in Table II.

TABLE II.

Variety.	A	B	C	D
per acre lb. s/c.	1307	871	1178	1347
ield per acre lb. lint	423	340	448	488
Lint percentage	32·4	39	38	36·25

It will be noted that varieties A, C, and D produced more seed cotton and lint per acre than B, although they had a lower lint percentage, A being only 32·4 per cent. as compared to 39 for B. This experiment was carried out on alluvial clay loam where varieties of the type of B are not suited, especially in seasons of heavy rainfall at mid-crop. In the drier districts such a variety, which is of the drought-resistant type, has much more promise of producing the highest yield of lint per acre.

Randomised Blocks.

Where three or more than six varieties are to be tested, it is advisable to use the method known as Randomised Blocks, for with three varieties there are not enough plots in a Latin Square, and with more than six varieties a Latin Square becomes too cumbersome, for there would be thirty-six plots when testing six varieties, as each variety has to be repeated as many times as there are varieties. With three varieties four or more plots of each are preferable, while with over six varieties four plots of each are ample to measure fairly small differences in yielding ability if the soil is at all uniform. The main feature of a randomised block experiment is that it is much more elastic than a Latin Square, although it does not measure small differences in yields with quite such precision. A farmer with a 100-acre field of varying fertility in the different portions may use a randomised block experiment to ascertain the most suitable of several varieties for the whole of his field, by planting a block consisting of one acre of each variety in several places in the field. The yields obtained from each acre plot can be combined into one experiment for analysis to ascertain if any one of the varieties gives a definite indication of being the most suited on the average for that field.

Likewise, varieties may be tested for a subdivision of a district, by each of eight or ten growers planting equal areas of all varieties being tried. All the growers must plant at the same time, however, use the same cultural methods, and carry out comparable standards of cultivation, otherwise there will be so many variable factors affecting the results that the main question—Which variety is the most likely to yield the best on the majority of the soils in the area?—cannot be answered. The Cotton Section of the Department of Agriculture is using this method in conjunction with Latin Squares, in order that all soil types in a district may be sampled, and a large number of growers have the opportunity to study several likely varieties for their areas

without running any risk of losses of serious consequence. Decidedly greater accuracy could be obtained, however, if all the growers planted Latin Squares, for then it could be decided which was the most suitable variety for each grower.

Student Method.

In some cases a grower may be interested in trying only against his regular one, and where this is desired a simple y... test is available. It consists of planting alternate plots of six or ... rows of each variety until at least four plots of the first variety an.. three of the second one have been sown, i.e., seven plots in all. At picking time the plots are harvested as shown in Plan II. This plan is well suited for testing two varieties on a slope, for one variety is first on the up side and then on the down side of the other, and if any consistent superiority in yield is shown, it is fairly indicative that the leading variety is the better one and that soil variability has not produced the difference in yields.

PLAN II.

Plot	1	2	3	4	5	6	7
Variety	A	B	A	B	A	B	A
6 rows	123456	123456	123456	123456	123456	123456	123456
Row numbers to be picked separately for weighing	4, 5, a^1	2, 3 b · 4, 5 b^2	2, 3 a · 4, 5 a^3	2, 3 b · 4, 5 b^4	2, 3 a · 4, 5 a^5	2, 3 b^5 · 4, 5 b^6	2, 3. a^6

Only the numbered rows, namely, the fourth and fifth in plot A1 and the second and third in A7, and rows 2, 3, 4, and 5 in the other plots, are weighed. The yields are then compared as shown on the bottom line of the plan, a^1 against b^1, b^2 against a^2, &c., the two rows in each case being added together to represent a plot yield.

Analysis of Results.

The value of conducting experiments along the lines of the three methods which have just been described lies not only in obtaining the average yield of a variety from several scattered plots in a field rather than from only one plot, but also in that the results can be analysed to ascertain how reliable they are. With only one plot of each variety there is no way of determining how reliable the yield is. Methods have been devised whereby the results of experiments, like the ones described, can be studied, and an estimate made as to the probability of the yields being thoroughly indicative of the merits of each variety. The significance of the results is expressed in odds such as 19 to 1. This means that if the experiment could be repeated twenty times on the same soil and under the same climatic conditions, in only one trial would a variety which was so significantly ahead be likely to be surpassed by any of the other varieties. Investigators throughout the world accept odds of 19 to 1 as being indicative of reliable ability on the part of one variety to outyield another.

It is necessary that such an analysis be made of the results obtained from experiments. In many tests of cotton varieties that have been

conducted here, yields have been obtained which would appear to indicate that a variety might be ahead by a substantial margin, yet when the data were analysed no significant differences were shown, that is, the odds were less than 19 to 1. In some cases checks on the yields from the experiment were available in the form of pickings from the portions of the rows that were not used in the experiment, and the variety which was ahead in the test but not significantly so, was surpassed in the bulk pickings by the second highest yielder in the test, thus demonstrating the validity of the conclusions drawn from the results obtained in the experiment.

More Varietal Testing Required.

It can be seen, therefore, that careful testing of the merits of each variety will be necessary before their full possibilities will be known. The tendency of many of the growers to try only one plot of each variety will have to be changed if this is to be accomplished, for while valuable information can be obtained from such a method as to the opening of the bolls, freedom from insect pests and the general suitability of a variety for a district, no accurate comparison can be made as to the relative yielding ability of the different varieties which may be thought to have possibilities. The new tariff schedule will necessitate more of the harder bodied cottons being grown. This possibility was visualised several years ago, and ample supplies of seed are available to meet requirements. The most suitable soil types and districts for these varieties have been fairly well ascertained, but it is necessary that they be extensively tested in carefully conducted experiments in order that the most profitable for each main soil type and district can be determined. The Department of Agriculture and Stock is investigating the merits of a large number of varieties, and as their requirements become understood they will be released for general testing. Unless sufficient growers co-operate in conducting reliable tests of them, the true value of each variety cannot be ascertained. A large number will eventually have to be discarded, for it is advisable to grow as few varieties as possible on account of the danger of contamination of seed at the ginneries, and to establish a general uniformity of lint produced. Without the results from a comprehensive series of carefully conducted tests, it will be extremely difficult to decide on the most valuable varieties to keep.

The growing of only one variety in a district is highly advantageous if at all possible, not only on account of the pure seed operations, but where only one variety is grown the growers will concentrate on studying their cultural methods to ascertain causes of low returns rather than blame the variety they are growing. If most of the growers in a district are obtaining good yields from a variety, there is obviously some local cause for failure on any particular farm, and experiences over several years have indicated that the explanation of such low yields can often be obtained without changing the variety. It is to be hoped, therefore, that greater interest will be shown in carrying out properly designed tests. The Cotton Section of the Department of Agriculture and Stock has prepared plans for the laying out of such experiments as have been described, and will be only too pleased to forward the same free of charge to interested growers, and to analyse

the results obtained if returned to the Department. Anyone interested in carrying out such tests should communicate with the Cotton Instructor for his district, or with the Department of Agriculture and Stock, Brisbane, giving information as to his soil type, the acreage to be sown, results that have been obtained with cotton in the past, and varieties that have previously been tried.

A CALF-PROOF GATE.

The gate illustrated is a handy type of bush gate in common use in Western Australia. It is made of round bush timber. The top rail and latch posts are made of forked posts, bolted together; the fork on the top rail makes the gate rigid, as it acts as a brace, and the fork on the latch post is at right angles, and prevents the gate from sagging and leaning over when closed; also when open it stands upright in any position, and it is easy to close. The hinge end of the gate is simple. Bore a hole in the top of the post and through the top rail, and insert an iron peg with a big washer or piece of iron plate with a hole in it. The washer makes it turn easier. Taper the post to a point, also to stop friction. The centre rails are hung loosely with wire; if a calf or sheep lean against them they push them upwards, and they cannot get through.

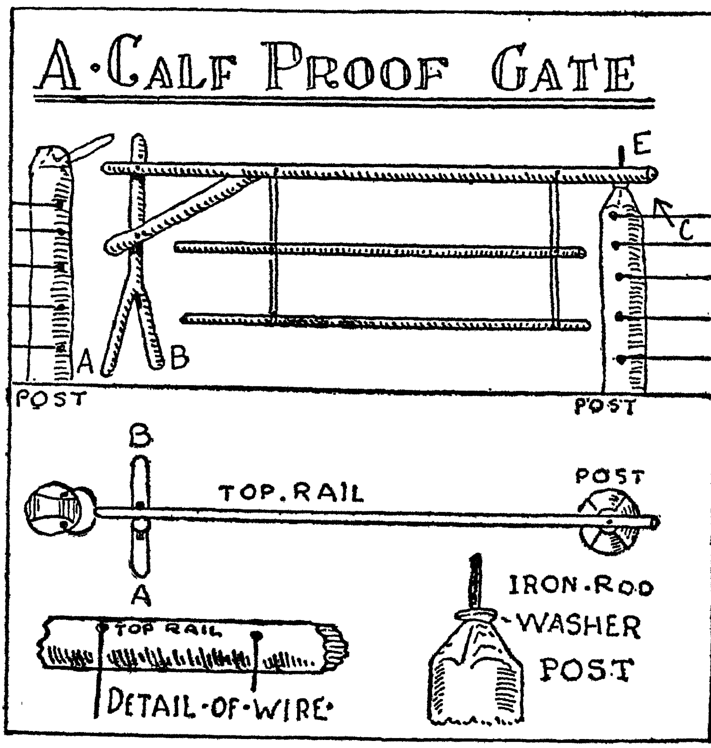


PLATE 150.

The top drawing shows the gate with posts at side and fence wires. The upright latch post of the gate has a fork A B, at right angles to the gate. E is an iron rod on top of the hinge post. C shows the position of the washer. The second sketch shows a plan of the gate. The bottom left-hand sketch shows the position for boring holes in the top rail for wires near the top of the rail. The bottom right shows the gate post tapered off, washer, and iron rod. This gate is cheaper and a lot handier than wrestling with an ordinary wire gate.

Factors Relating to the Production of the Harder-Bodied Cottons.

By W. G. WELLS, Director of Cotton Culture.

THE Tariff Schedule tabled recently has enlarged the market for the Australian spinners in several classes of yarns that can best be manufactured from the harder-bodied 1 to $1\frac{1}{16}$ inch cottons. It will be necessary, therefore, for the Queensland growers to produce more of this class of cotton in order that the spinners may operate on the most efficient basis. Fortunately, it appears entirely feasible to supply the quantities of such cottons that will be required, provided proper attention is paid to the selection of soils suitable for their profitable production. The following article has been prepared to present to growers important factors bearing on the production of these types of cotton.

Results from Early Tests of a Variety Producing a Hard-bodied Cotton.

The Department of Agriculture and Stock realised in the early stages of this present phase of cotton-growing, that varieties producing the harder-bodied medium staples would probably be required for some of the climatic conditions of the districts where cotton might be grown. Seed of the Lone Star variety, which was the outstanding American cotton of this type at the time, was accordingly imported in 1923, and fairly satisfactory results were obtained with it at first. Very unsatisfactory yields were generally produced, however, when more extended tests were made, especially in the districts with harsher climatic conditions where such a variety might have been expected to be eminently satisfactory. Tests were continued with it, however, and breeding operations were instituted to develop suitable acclimatised strains, for in a few trials it produced profitable yields of fibre of good quality.

Explanations of Early Results.

In the course of further investigations in the Lone Star and other varieties, it became apparent that many of the problems connected with growing cotton in this State were not solely a question of finding suitable varieties, but in reality the much broader subject of either selecting suitable soils, or of adopting cropping systems which would maintain the soil in a proper condition for producing profitable yields of cotton. With the opening up of the Upper Burnett-Callide Land Settlement Scheme for closer settlement, large areas of virgin country were brought under cotton cultivation. During the first few years excellent returns were obtained, especially on the alluvial soils, but with continued cultivation of cotton, the returns diminished steadily. It was noted, however, that the yields obtained on land newly brought into cultivation, though often adjacent to old cultivations, were generally satisfactory, and in the investigations of the causes it was ascertained that the nitrate content and carbon-nitrogen ratio of the soils played a very important part in the returns that were obtained from cotton.[1] When this aspect of the work had been well demonstrated, the possibilities of producing a wider range of cottons in many of the districts were greatly increased.

(1) See "Cotton Growing on New Cultivations," by W. G. Wells, "Queensland Agricultural Journal," April, 1934.

Further Importations of the Harder-bodied Cottons.

More varieties of types producing the harder-bodied cottons, which, in the earlier stages of cotton growing here, did not appear to have possibilities for many of the districts, have accordingly been imported, and with proper selection of soil types several have yielded promising results under a wide range of seasonal conditions. The seed stocks of these were increased, and during the 1933-34 season sufficient supplies of the varieties yielding the harder-bodied 1 to $1\frac{1}{16}$ inch cottons of good strength were produced to meet all requirements. Breeding centres have been established for each of the most promising varities, and supplies of improved seed are being developed. Test plots and varietal trials have been conducted of all except the most recently introduced varieties, and a sufficient understanding of their possibilities has been obtained to allow of their allotment to growers with reasonable prospects of their producing profitable yields.

PLATE 151.—TESTING FOR STRENGTH AND DROUGHT RESISTANCE IN A BIG BOLL VARIETY.

Each season thousands of plants are examined by the Cotton Section of the Department of Agriculture and Stock, and upwards of 2,000 plants are picked individually for further inspection in the laboratory. Progeny rows of the plants selected finally as worthy of further study are planted in the following season in breeding blocks, where the uniformity of plant and fibre characters is carefully studied. The most promising progenies are kept for further increase and trial. In this manner suitable strains are being developed of the main varieties now being grown.

The position is, now, that the Department is faced with the problem of eliminating as many varieties as possible after their full possibilities have been ascertained. The co-operation of the growers on a much larger scale than has been given by them in the past, is therefore, necessary, in order that a comprehensive sampling of the various soil types in every district may be obtained with each variety. Carefully conducted varietal trials of the type described in "Varietal Testing"[2]

(2) See "Varietal Testing," by W. G. Wells, "Queensland Agricultural

will be required for several seasons before much elimination can be effected in some districts, while in others the problem will be simpler. As pointed out in "Varietal Testing," the trials must be of the proper type, however, for the tendency of the growers in the past to compare their results obtained from a field of only one variety, with that of a neighbour having a different one, or to compare the yields of single plots of several varieties on the one farm, is of little value as far as yielding ability is concerned, and often serious confusion of thought arises amongst the growers in a district, due to the conclusions obtained in such a manner. Undoubtedly, in many of the subdivisions of some of the districts it will be possible to reduce the number of varieties to one, or possibly two, where diverse soil types exist, and it is to the interest of all concerned that such simplification be speedily effected.

Suitable Soils for Varieties Producing the Harder-bodied Cottons.

Generally speaking, it appears that the big boll types producing the harder-bodied cottons will be better suited for the harder clays and clay loams of the following types:—The slopes originally under ironbark or box-trees; the poorer box flats, especially where they join the lower brigalow scrub slopes; the brigalow scrub slopes; and the brigalow and belah scrub mixtures. Likewise, the harder or the poorer soils of the brigalow and softvine scrub mixtures; the poorer shallow sandy loams overlying clay subsoils in both forest and scrub; and some of the heaviest clay types of the alluvials, such as the black soils of the open plains type adjoining the box country, are also well suited. All these soils, particularly if they have not been under cotton cultivation for more than four or five years appear to be capable of producing heavy yields of this type of cotton under reasonably favourable conditions. Which variety, is a matter of experimentation in some districts, while in others rather clear-cut indications have been obtained that some of these cottons are not suitable. It is confidently anticipated, however, that a satisfactory selection of suitable varieties can be accomplished if sufficient growers will assist in carrying out properly conducted tests.

It is pointed out, however, that it appears unlikely that over a series of seasons satisfactory yields will be produced with most of the big boll hard-bodied cottons, on the more fertile alluvial loams, or on the soft vine scrub soils of high nitrate content. In occasional seasons with either low rainfall, or when very heavy rainfall is experienced in the spring and early summer, and moderate amounts at mid-season, good yields may be obtained with these cottons over a wide range of soils.

Relationship of Soils to Varietal Types.

All the suitable classes of soils described above are usually of only moderate nitrate content and mostly have a stiff clay subsoil, a combination that seems to be very favourable for the production of satisfactory yields of cotton, especially of the harder-bodied types. The explanation of their suitability appears to be that with the low nitrate content and harder soils, only moderate plant growth is made, particularly in wet seasons when a partial water-logging of the soil tends to produce the effect of a physiological drought—the plants being of a small and toughened type. This does not appear to handicap the big boll varieties producing the harder cottons, but types producing medium-bodied fibre are undoubtedly sometimes affected during dry

periods. Investigations carried out at the Cotton Research Station have shown that the nitrates of the surface soils are easily leached through the first 18 inches of soil, and apparently where a clay subsoil exists around this level, sufficient nitrates and soil moisture are accumulated to enable the big boll types to carry through fairly stress periods with only moderate damage to either yield or quality of the crop.

A different result is obtained, however, on the deeper alluvial more fertile loams and clay loams, or on the deep scrub soils of high nitrate content. With the higher nitrate content of all these soils, a greater stimulation exists to produce a larger and sappier growth of plant structure of all varieties which is more subject to crop losses from various causes. Shedding in prolonged dry periods and then physiological shedding during luxuriant growth in a following wet spell; insect attacks removing a large amount of the crop and then rank growth occurring, afterwards accompanied by further insect attacks or physiological shedding, especially if wet weather of any duration is experienced, may all affect the returns obtained from these soils. The big boll harder-bodied types all tend naturally to make rather vegetative growth on such soils, and appear more susceptible to disaster than the more open types producing the medium-bodied cottons. Apparently if serious

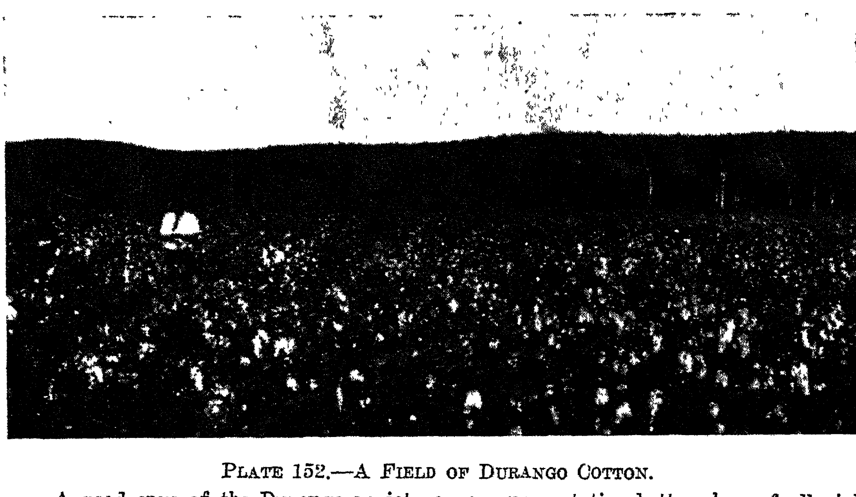


PLATE 152.—A FIELD OF DURANGO COTTON.

A good crop of the Durango variety on a representative better class of alluvial loam of the Callide Valley.

loss of crop occurs around mid-season in the big boll drought resistant varieties, there is such a definite tendency to the formation of what might almost be termed a determinate habit of growth, that only a light recovery of crop is effected, except under the most favourable conditions.

It has been clearly demonstrated, however, in investigations carried out at the Cotton Research Station, that the varieties of more open habit of growth and producing the medium-bodied cottons, such as Durango, Indio Acala, and Starvale, are quickly able to develop a fruiting structure well loaded with flower buds after a disaster has been experienced. If reasonably favourable conditions follow, a crop is obtained which, in some seasons, is of astonishing magnitude. This

particularly applies to Durango, which has often produced profitable returns in many of the districts after a serious loss of crop has been experienced, even as late as the end of February. This factor is of outstanding value on the alluvial loams, and unless a variety with similar ability can be found in the harder-bodied cottons, it is questionable if it will be advisable to substitute any of them for Durango, even a variety producing fairly satisfactory yields under average conditions, for Durango has so often produced profitable crops after disasters have occurred. It may be possible, however, to develop suitable strains of the medium-bodied cottons such as Indio Acala or Starvale for these soils, and investigations along these lines are in hand. As both varieties have a higher lint percentage than Durango, some increase in yield of lint might be obtained in seasons when late crop disasters are experienced.

The effect of soil types on the relative yielding ability of the high and low lint percentage cottons is shown in Table I. in a comparison of the results obtained in two varietal tests of the same four varieties conducted in a district in the 1933-34 season.

TABLE I.

SOIL TYPE—3 YEAR OLD CULTIVATION—LOAMY SOIL ADJACENT BRIGALOW SCRUB SLOPE.

Variety.	A.	B.	C.	D.
Yield per acre in lb. seed cotton	1307	871	1178	1347
Yield per acre in lb. lint cotton	423	340	448	488
Lint per cent.	32·4	39·0	38·0	36·25

SOIL TYPE—5 YEAR OLD CULTIVATION—ALLUVIAL LOAM ORIGINALLY COVERED WITH BLUE GUMS, MORETON BAY ASH, AND IRON BARK.

Variety.	A.	B.	C.	D.
Yield per acre in lb. seed cotton	1135	563	835	847
Yield per acre in lb. lint cotton	368	220	317	307
Lint per cent.	32·4	39·0	38·0	36·25

In the first experiment on the newer cultivation, and possibly slighter heavier soil, variety D significantly outyielded all others, and variety C barely significantly outyielded A. All were significantly better than B, which had the highest lint per cent. Thus, two of the three high lint percentage varieties were better than A—which had the lowest.

In the second experiment on the older cultivation of alluvial loam, the low lint percentage variety A, which was of the most open type of growth, significantly outyielded all. There was no significant difference between C and D, while B was outstandingly low again, although it was of the highest lint percentage. In both experiments B experienced the most losses from boll rots. The results of the two experiments are

clearly the necessity of selecting suitable soil types for the different varieties.

Necessity for Ample Supplies of Hard-bodied Cottons.

It must be remembered, however, that the New Tariff Schedule has extended the markets for the Australian spinners in the yarns requiring the harder-bodied cottons. It is necessary, therefore, that ample supplies be grown of such cottons, and where there appears any possibility that they can be grown profitably, the Department is allotting seed of the most suitable varieties producing these types of lint. Fortunately, large areas of the harder-soil types occur in many of the main cotton-growing districts, so that it will be possible to grow ample supplies of such cotton. As these soil types are less suitable for the medium-bodied cottons in very dry seasons, a higher general quality for the whole of the Queensland crop should be obtained over a series of seasons. Growers with suitable soils such as have been described in this article should, therefore, apply for seed of the harder-bodied cottons.

Lint Percentages.

The introduction of varieties producing the harder-bodied cottons has brought into prominence the question of the advantages of producing varieties with a high lint percentage, and undoubtedly many growers will be inclined to grow them under the impression that the higher lint percentage a variety has the greater will be the yield of lint per acre. This appears plausible, but has been disproved in Queensland and in many other parts of the world. The suitability of the high lint percentage varieties producing the harder-bodied cottons depends largely on the soil type and the seasonal conditions. Where suitable soils such as have been described are available, undoubtedly under average conditions, yields as heavy or even appreciably heavier than those produced by the lower lint percentage cottons will be obtained with some of them, and often the quality of the lint will be superior, especially in dry seasons. It does not follow, however, even on suitable soils for the cottons producing the harder-bodied fibre, that the variety with the highest lint percentage will produce the most lint. A variety which does well in a district usually experiencing fairly good rainfall may not be at all suitable for a drier district, although it is planted on suitable soil types in both instances. Conversely, one of the big boll drought-resistant cottons with a very high lint percentage may yield excellently in a dry district, but will give very poor returns of low-grade lint in a wet district, even if planted on a soil suitable for the big boll types. The following data, which was obtained in an experiment conducted in the 1933-34 season on a bloodwood-ironbark slope well suited for the production of the big boll types of cotton, illustrates the point clearly, and shows the necessity for growers to conduct carefully planned experiments to ascertain the most suitable variety for their conditions, rather than to order a variety because it has a high lint percentage.

Variety.	A.	B.	C.	D.
Yield per acre in lb. of seed cotton	1059	656	817	867
Yield per acre in lb. of lint cotton	363	256	310	317
Lint percentage	34·3	39·0	38 0	36·5

Variety A, which was of the lowest lint percentage and was of the quality desired by the Australian spinners for a large amount of their yarns, significantly outyielded all other varieties, while B, which had the highest lint percentage, was significantly lower yielding than any.

Lint Percentages do not Necessarily Determine the Value of a Variety.

It can thus be seen that a high lint percentage does not necessarily indicate a high yield of lint. Soil and climatic conditions, susceptibility to insect attacks, plant structure, and quality of fibre produced, play an important part in the results obtained from a variety of cotton. This is recognised in all cotton growing countries. In some parts of the United States of America the varieties with the highest lint percentages produce outstandingly the heaviest yields; in other parts, generally in the same State, soil or climatic conditions make the production of substantially lower lint percentage varieties decidedly more profitable.

It is necessary, therefore, that a wide range of cottons differing in lint percentages, types of fibre, habits of growth, &c., be tried, and the Department of Agriculture and Stock has a large number of varieties under trial which have been obtained from different countries. In the first tests some of these have produced excellent yields, but the drag of the fibres was so lacking that decided improvement was obviously required before the variety could be grown commercially. Drag is the name used to describe the clinging power of the fibres, and unless a cotton has a good drag it handicaps the spinner in producing a strong yarn. Other varieties have yielded very well, yet the general quality of the fibre was lacking in many respects. A considerable number of varieties have been discarded for various causes, after careful testing for several seasons, which is the period required before the true merits of a cotton are known.

It is suggested, therefore, that before ordering planting seed a grower should get in touch with the Cotton Officer of his district, or write direct to the Cotton Section, Department of Agriculture and Stock, Brisbane. A description of the soil type on which cotton is to be grown should be included, along with such details as the acreage; trees originally on the soil, whether slope or alluvial, if old or new cultivation, results that have been previously obtained with cotton, and the varieties tested. The most promising variety will be allotted, based on results that have been obtained in tests carried out under similar conditions. It must be realised, however, that any variety of any agricultural crop may fail under unfavourable conditions. Unforeseen circumstances may cause poor returns or failures to be obtained from the selected variety. If it is a big-bolled hard-bodied type of cotton, it does not follow that these cottons are not suitable for the particular soil, for it has been shown how varieties yield varying returns according to soil and climatic conditions. If unsatisfactory results are produced, a test should be applied for in the following season to ascertain the most suitable variety, as varieties are now available for the majority of our cotton soils.

Conclusions.

1.—A greater production of the harder-bodied medium staples is now required in Queensland.

2.—A sufficient acreage of suitable soils is available in the regular cotton districts to produce ample supplies of these cottons.

3.—The harder types of soils are the most suited for the profitable growth of the varieties producing cotton of such character.

4.—These varieties are not generally suitable for the more fertile loams of high nitrate content, especially the alluvials of the districts of heavier rainfall.

5.—The medium-bodied cottons have yielded the best returns so far on such soils.

6.—The varieties with the highest lint percentages do not necessarily produce the highest yield of lint on all soil types.

7.—The harder-bodied cottons should be grown wherever the soil types are suitable, but it is suggested that the Cotton Section of the Department of Agriculture and Stock, Brisbane, or the District Cotton Instructor, should be communicated with regarding the most promising variety.

ANOTHER USE FOR A RAZOR BLADE.

Leather belt lacing frequently requires trimming, and when this is the case and a belt breaks, one often has quite a problem to effect repairs without losing too much time. An excellent tool for cutting belt lacing or even trimming the ends of belts when shortening is necessary can be made from a discarded safety razor blade, which

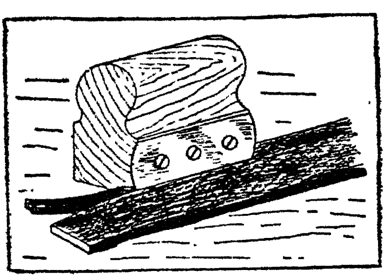


PLATE 153.

is mounted on a block of wood. The block should be curved to fit the fingers and one side at the bottom grooved or relieved to the width and thickness of the lacing required. The blade is then fastened to the block with small wood screws and the relieved portion of the block will then serve as a guide so that the edge of the blade is always parallel and the lacing will be of equal width along its length.

Common Mistakes in Bright Tobacco Production.

By N. A. R. POLLOCK, H.D.A., Senior Instructor in Agriculture.

IT is probable that in looking back on their efforts in the production of bright tobacco in the past and previous seasons there are few growers who do not recognise that there was much room for improvement in yield as well as quality in the crops they produced.

In "Tobacco Growing in Queensland" an endeavour was made to define a correct procedure in the production of a crop through various phases, from soil selection to the marketing of the leaf, as well as in pest control and precautions to be taken in the prevention of disease.

While slight departures from the lines laid down may not in certain directions be detrimental, carelessness in others has been the forerunner of more or less diminished yields with reduction in quality.

Just as a faulty foundation imperils the structure built thereon, so a wrong procedure at the outset in crop production is liable to foreshadow misfortune later on.

Seed-beds.

In a tobacco crop particularly, the provision of strong, healthy plants to set out in the field from the seed-beds is of maximum importance.

The soil of the seed-beds should be fine, friable, and fertile, and contain a good supply of humus and decaying organic matter; an advantage is usually gained when a top-dressing of superphosphate or a complete tobacco fertilizer at the rate of one to one and a-half ounces to the square yard is given prior to sowing the seed.

Seeding should not be too heavy, a small teaspoonful or one-twelfth of an ounce being sufficient for 100 square feet. Water should be applied judiciously to allow the plants to make a strong, uninterrupted growth up to the time of transplanting. Where plants are crowded they should be thinned or pricked out into another bed.

Faults with many seed-beds were noted as infertility, insufficiency of organic matter, and poor texture. In the latter, coarseness of the particles, as in very sandy soils, disallowed sufficient retention of moisture and the necessary close contact with the tiny rootlets when the seeds had germinated. In clayey soils overwatering caused stunted growth and root troubles.

Failure to burn the beds also allowed nematode infestation and probably some of the trouble from fungi.

Growers are advised to pay particular attention to their seed-beds. A good plan is to dig in fresh supplies of farm yard manure or well-rotted vegetable matter each year as soon as the fields have been planted up, and to grow table vegetables thereon until the approach of the next season when the beds should be dug up and fired in preparation for seeding. Firing of the seed-beds each year should not be neglected.

Disease.

Disease cannot be regarded as a natural concomitant of either plants or animals. Each is provided with a natural resistance proportionate

to its vigour, but when vitality is lowered through inbreeding, injudicious mating, improper selection of seed, inanition or ill-treatment, such is more readily overcome and trouble engendered. The tobacco plant is probably more subject to attack from fungous diseases with consequent loss than any other cultivated. This fact is insufficiently appreciated by the average grower whose carelessness is responsible in most instances for losses in seed-bed and field. Blue mould is by far the most damaging trouble experienced. As far as is known its attack is confined to species of the genus nicotiana, plants of other species, even when somewhat closely related, appearing to be immune. While with many crops the major diseases are more or less controlled by the growth of known resistant varieties, no success in the evolution of a variety of tobacco resistant to blue mould has yet been obtained. In its incidence, it is analagous to Late or Irish blight which occasionally causes much loss in crops of potatoes and tomatoes, since it appears epidemic in certain seasons when climatic factors probably operate to favour its development.

The fact that in seed-bed and field a mild attack is sometimes confined to a few plants here and there suggests a lack of vitality therein may be responsible.

Particular attention should be paid to seed-bed sanitation in order to promote strong growth of plant. Early growth is invariably more susceptible to disease than later, and it is in this stage that troubles are most often contracted.

In addition to care in the preparation of the seed-bed further precautions against disease should be taken in the application of fungicides, particulars of which are set out in the admirable contribution on diseases to "Tobacco Growing in Queensland" by Mr. L. F. Mandelson, and also in his Additional Recommendations for the Control of Blue Mould, Advisory Leaflet No. 7, published by the Department of Agriculture.

Sprayings to be effective should not be applied perfunctorily but regularly, as advised therein and according to directions. The objective, it should be understood, is to prevent the entry of disease by the destruction of spores which may come in contact with the film of fungicide covering the young plant, hence the necessity to maintain this film by regular and frequent applications in such a manner as to keep covered both under and upper surfaces of the leaves as well as the stems.

Once contracted, disease in the plant is not regarded as possible of cure, certainly not within a time that would allow of adequate return during the season of growth. The cost of material and labour involved in the control of disease and insect pests is not high and will be repaid many times from the added value of the crop returned.

In field practice much of the trouble experienced from leaf spots would have been avoided, or at least lessened, by heavier priming. This allows access of light and a freer circulation of air at the base of the plant, both of which are regarded as repellant. The removal of these leaves, usually of poor texture, cannot be regarded as a loss, but rather as a gain, for the nourishment otherwise used in their development will be devoted to the production of others higher on the plant, which will be of better body and not damaged by contact with the soil.

Insect Pests.

Much of the trouble caused by insect pests has been due to unsound cultural practice in which failure to eradicate and destroy plants

immediately harvest of leaf therefrom has been completed or abandoned as well as volunteer plants was common.

Careful perusal of the subject matter of "Tobacco Pests," by Mr. J. Harold Smith in "Tobacco Growing in Queensland," should convince growers that sound cultural practice will very seriously diminish such insect population.

Two of the worst tobacco pests are the stem grub or borer and the leaf miner which are closely related. As their depredations occur within the leaf or stem, control is not possible by sprays or poison baits. Destruction of the grub by burning the leaf or affected part of the stem immediately attack therein is noted is strongly advocated. Mr. Smith advises the adult moth is capable of laying as many as 150 eggs. The destruction thus of one grub or its pupa suggests protection from the ravage, potentially, of 150 individuals two or three weeks later. His remarks on the practice of many insects to pupate in the soil are worthy of note, as they stress the value of cultivation during growth and between seasons.

Fertilizers.

The use of fertilizer on the tobacco crop is not as general as is considered desirable. Even the most fertile soils produce a better leaf quality under judicious applications, since ripening is thereby accelerated and a better colour secured under cure.

Trials repeated in different districts and on various types of soil over a series of years will be necessary before a definite recommendation of a particular mixture for each can be made. So far, however, results from the use of the 4—12—6 mixture suggested in "Tobacco Growing in Queensland" are most encouraging, so much so that it is confidently predicted the conclusive result of years of experiment will be a recommendation of this mixture or of one very close thereto. Used at the rate of 2 lb. to the chain of hill or row, it has, in competition with other mixtures, given the best results, not only on the poorest soils but on the most fertile on which tobacco has been recently grown.

Where plants are set out in rows 4 feet apart the collective length of rows in an acre would be approximately 160 chains. At 4 feet 1½ inches it would be exact. Applied at 2 lb. per chain 320 lb. would be necessary for the acre or 1 ton sufficient for 7 acres. The 4—12—6 mixture, according to the Departmental formula, is quoted at £11 per ton f.o.b. Brisbane. Allowing as much as £3 per ton for carriage to the farm, an application of 320 lb. would signify an expenditure of £2 per acre.

Green Manures.

Leaf quality is definitely influenced by the quantity of humus and decaying organic matter in the soil, a fact that is insufficiently appreciated by growers. Many will have noted the absence of the lustre or shining brightness in cured leaf of later crops that was so apparent when virgin soil was first used for the purpose. Experience of tobacco leaf auction sales suggests that lustre in the leaf offered means an advantage of at least 3d. per lb. This increase in return, without consideration of the higher yield, would more than compensate for the cost involved in growing a crop and turning it under for green manure. A sufficiency of humus in the soil is absolutely necessary for profitable production, and its maintenance should be the objective of every grower.

Where it is practicable to to grow other money crops, such as maize or potatoes, that benefit from the turning under of a legume, cowpeas or velvet beans in summer, or field peas or vetches in winter, can be commended as green manures provided a crop of another kind precedes tobacco. Where tobacco is to follow a green manure, Sudan grass, sorghum, maize, or millet in summer, or ryecorn, barley, wheat, or oats in winter, offer choice.

Irrigation.

Over-irrigation, improper application of water and under-cultivation conjointly, were the cause of poor returns in many instances. Excess of soil moisture induces root rots through which leaf is apt to yellow prematurely and quality suffer, while in extreme cases, especially in early growth, the plant may be killed. Personal notes in the June, 1934, issue of the "Queensland Agricultural Journal" are worthy of perusal.

The practice of setting out plants in or on the side of the furrow carrying the water in irrigation is undesirable. Though the strike is generally satisfactory through root contact with wet soil, subsequent growth is impeded by the brick-like structure of the soil consequent on the evaporation of moisture therefrom. Further applications of water certainly soften the soil for a little while but add another defect in promoting root or stem rot.

Growth on hills with fewer applications of water and more cultivation to aerate the soil and retard evaporation is calculated to improve yield and leaf quality.

Spacing.

The setting out of plants at intervals of 2 feet in rows 4 feet apart appears to be most satisfactory and is generally recommended. Closer spacing in and between rows tends to exclude sunlight and prevent the free circulation of air. Leaf, as a consequence of growth in the shade, lacks body and does not sell so well. With lesser intervals between rows, also, cultivation cannot be so easily effected.

Cultivation.

Lack of cultivation was not generally common, but is capable of improvement, especially close to the plants. Weed growth should not only be kept down but a loose surface maintained in the soil up to the time of topping, when further attention is neither necessary nor desirable.

Priming.

As noted previously, improvement can be effected by a heavier priming than is usual. Not only will leaf quality be improved without diminution of yield, but damage from fungi causing leaf spots will be lessened.

Topping.

Experience has convinced most growers that it is better to delay topping until a few flowers have opened and then to top high rather than low. In a good growing season high topping is imperative as otherwise the leaf is apt to become coarse and cure a darker colour than is desirable. With high topping the two or three top leaves, usually narrow, are not worth harvesting. The amount of nourishment for their production is compensated by the better texture of lower leaves and the lesser growth of suckers.

Suckering.

Neglect of suckering was to be seen in many instances where they had produced flowers. Loss was consequently sustained in leaf body and damage to the web when picking. Too frequently the grower had planted an acreage beyond the capacity of the labour available. Suckers should be removed when they are about an inch long, as they are then easily broken off by pressure of thumb or finger. Working with both hands systematically, with an appreciation of the manner in which the leaves spiral the stem, the operator soon becomes expert. When suckers are allowed to grow more than 2 inches they are not so easily broken, frequently the leaf adjoining is broken off, and, at times, the sucker has to be cut with a knife. The longer time occupied, then, adds to the cost of production while leaf quality is adversely affected.

Harvest.

Perhaps in the selection of leaf that has reached a desirable degree of ripeness the most common fault of growers is to be found. Too frequently under-ripe leaf is included in the barn, and the cured colour of the whole more or less spoilt while waiting for it to yellow.

Inability to recognise the change of colour to ripeness is sometimes due to colour blindness, a failing especially in gradations or shades of colour that is not very uncommon.

Growers should recognise that the lowest leaf on the plant, which is also the oldest, will invariably be riper than the one immediately above. At times a leaf further up the plant, above known unripe leaves, will show a tinge of yellow or be pronouncedly so in one part. This does not signify ripeness, but is the result of an impediment in the fulfilment of its function due to broken veins or midrib, a grub in the latter or in the stem near the junction of the leaf; it may be also due to disease. Such a leaf should not be included in the cure. Under-ripe leaf, no matter how well treated, possesses a characteristic aroma which cannot be disguised. Its presence is easily detected by a buyer and a lower price is offered or purchase declined.

When picking, if doubt is felt regarding ripeness, the leaf should be left. Following this course few leaves will be found over-ripe at the next picking, but their loss will be more than counter-balanced by the better price received than if under-ripe leaf was included.

Experience is the only sure guide to a recognition of ripeness. By marking doubtful leaves and observing their behaviour from day to day a perception of ripeness is most easily attained.

Ripeness in coarse or heavy leaf, due to low topping or growth too late in the season, is indicated in a brittleness of the leaf, of which the tip curls downward and the edges frequently inward. Folding part of the leaf under and flattening with slight pressure, ripe leaf will show a clear break. Folded upward unripe leaf will crack across but the break will not extend to the surface cuticle.

Leaf of this character is best cured by itself, but if there is insufficient to warrant the use of a barn for the purpose, it is best strung separately and placed out of sight on the top tiers of the barn.

Care in handling leaf at all times is most desirable, since broken stems are conducive to lower prices.

Curing.

Faults in curing are many and varied; heats are most frequently raised too slowly and at times too quickly and over-ventilation is often a cause of poor colour and sponging.

In raising the heat it should be recognised that the atmosphere is heated more quickly than the leaf, hence the necessity in the earlier stages for the rise to be not more than 2½ degrees in the hour, with usually a pause after every 5 degrees rise.

Following the instructions for the cure of light, medium, and heavy leaf in "Tobacco Growing in Queensland" most growers have obtained satisfactory cures. Few, however, have kept records of each cure or made notes on the behaviour of leaf during the process. No hard and fast rules can be laid down, but if access of colour, hardened tip, shrivelled end, curled edges, dried web, and later veins are recognised as guides for rise of temperature and alteration of ventilation, good results must follow.

Notings of behaviour in one cure can be expected to influence betterment in others following. Faults in ventilation were chiefly in an excess both top and bottom.

An extreme instance of this was noted where a 16 by 16 feet barn was provided with eight rabbit-hutch type of bottom vents, two on each side, each 30 by 12 inches, making the total area of opening 20 square feet. The top vent along the full length of the ridge was 16 by 2 feet representing 32 square feet. The grower, who experienced much sponging during a lengthy period of cure, expressed the opinion that a better result would be obtained if the whole of the roof could be removed. Needless to state the consumption of firewood per cure was also excessive.

In the instructions for curing, the amount of ventilation is suggested as an inch or so, a quarter, a half, and full, but when the area of the vents is not in accordance with that approved under Flue-curing Barns in "Tobacco Growing in Queensland" the terms are apt to mislead.

The actual amount of ventilation required is hard to determine as it varies with the fullness of the barn and the body of the leaf therein.

It has been calculated, however, that a superficial top vent opening equal to 2½ per cent. or one-fortieth of the floor area of the barn with a provision at the base equal to half that on top is usually adequate.

This would mean that in a 12 by 12 by 16 feet barn the top vents when fully open would represent a superficial area of 3·6 feet or 518·4 inches—say, 4 square feet. Those at the bottom would be 1·9 feet or 259·2 square inches—say, 2 square feet, which is half that on top.

In a 16 by 16 by 16 feet barn the floor area would be 256 square feet, one-fortieth of which would mean 6·4 square feet—say 6½ square feet—as full ventilation on top and 3·2 square feet—say 3¼ square feet—as full ventilation below.

In erecting barns it is usual to install a sufficiency of top ventilation on each of the two sides of a gabled roof or on each of the four of a hipped roof so that the vent or vents on one side only, opposite to the direction of the prevailing wind, would be used when curing.

Bottom ventilators are usually placed two at the back and two at the front of the barn to allow of additions being made thereto and similarly used. Two or the whole four may be used, but the amount of opening given should not collectively exceed that suggested.

Where the air on entering the barn comes in immediate and close contact with the hot flues a great advantage is gained.

Excessive ventilation is mainly responsible for sponged leaf. When the top vents are too large the temperature at the higher tiers is much reduced. With too much bottom ventilation the ascending air is not evenly heated.

Where top vents are open in the direction of the prevailing wind, a fault of not infrequent occurrence, the outward flow of used air from the barn must be hindered and cold air enter. The result is a delay in the cure with deterioration of colour.

The heating system also in many barns is capable of much improvement.

Bulking.

Occasional instances of the inclusion of fat stems and of leaf being bulked with too much moisture have been noted, followed by neglect to examine condition periodically, especially after a fall of rain. As a result darkening of colour and even moulding have occurred.

A good plan is immediately on removal from the barn to bulk the leaf down on the sticks and to cover the bulk for a day or longer before taking it therefrom. This will necessitate a double set of sticks for each barn and somewhat more space in the bulkshed. Advantage will be found in a greater evenness of condition and the opportunity to roughly grade the leaf into Bright, Medium, Dark, and Green, with more certain exclusion of fatty stems. This expedites and reduces the cost of subsequent grading for sale.

Grading.

The grading of leaf on the farm is commended as the grower thereby gains a better idea of quality and is impressed with the directions in which improvement is most desirable.

As a general rule, home grading has been approved by buyers. There is perhaps a tendency to make too many grades, a fact which is reflected in a number frequently realising the same price when sold. This, however, is to be commended rather than condemned as it will be righted as experience is gained.

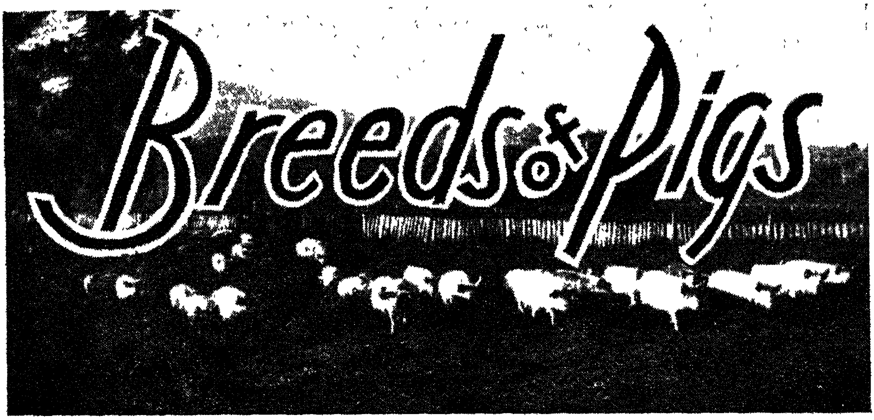
In grading, colour only is most often the only guide followed. Body and damage should also be considered. Papery leaf is of less value than that of medium body, likewise boardy leaf is inferior to that with good elasticity. Even though colour may be uniform, diversity in other directions can be expected to adversely influence price.

Where a uniform growth is made each picking is of leaves occupying practically the same position on the respective plants and is mainly uniform. When each cure is roughly graded before bulking, those from the different pickings can be kept separate. This practice will not only facilitate grading for colour but also for size and quality in other directions. Broken stems are anathema to the buyer as cost of handling at the factory is thereby increased. They should be graded out and baled as scrap, for inclusion with whole leaf lessens the offer.

Handing.

Hands frequently carry too many leaves and are unduly large, while ties as a rule are far from neat.

The grower is known by his product so, when grading is done on the farm his care or otherwise, therein, becomes known to the buyer whose offers of purchase are correspondingly influenced.



E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PART II.

THE MIDDLE WHITE.

PURE white in colour, of a conformation similar to that of the Berkshire, and having unique qualifications as a breed specially adapted for the production of pigs suited to the pork trade, the Middle White—still referred to frequently as the Middle Yorkshire, the Mid-White, and the Medium York—is without doubt one of the breeds in which pig raisers in this country should be especially interested.

British in origin, its home in the heart of Yorkshire, England, it has an historical record like that of the Large White, full of interest especially to those who like to delve into records and try to get back to the beginning of things. Possibly it is difficult to indicate with any degree of certainty just where and when this well-known breed had its actual beginning. Doubtless it originated among those of our forefathers who, as stockmen, instead of depending upon a more weighty, growthy, and mature pig preferred to make a selection from available stocks of a type more blocky in stature and conforming particularly to the peculiar requirements of the pork butcher than whom there was no more particular connoisseur associated with the meat world.

Originally there was but one Yorkshire breed, a popular and profitable animal, the product of selection from types developed following the introduction into Great Britain of the Chinese type, and its use in grading up from the original wild hogs of Yorkshire and Lancashire.

Early History of the Middle White.

In 1860 prominence was first given to the qualifications of this type of Yorkshire pig, and about the same time they were first brought before the public at stock fairs and village shows. Three distinct offshoots from the original parentage had thus been developed, the Large White, whose history was traced in the August issue of this Journal; the Middle White, with which we are at present concerned; and the Small White, to which reference is made later in these notes.

It is of interest to note that the Middle White has, all along, maintained its place in the pig world, because of its docility, prolificacy, prepotency, quick and easy growth, and adaptability—breed characteristics no less valuable in these days of keen competition than they were in those far-off days when farmers knew but little about breeds of pigs.

Notable among early breeders of this type were the Wainmans, whose boar, "Lord of the Wassails," was the first male of the breed to win a prize at the Royal; they were prominent fanciers of this type for many years after that. Then followed the Harrisons of Stockport, the Duckerings, Collinsons, Mangles, Peter Eden (who owned a sow, "Gem," which produced seventy-four pigs in six litters), the Stricklands, the Earl of Ellesmere, Sir Gilbert Greenall, Ashford of Rufford, the Twentymans, and in later years among a host of others, the venerable Sanders Spencer of Holywell, whose name will for ever remain associated with progressive stock raising in the nineteenth century.

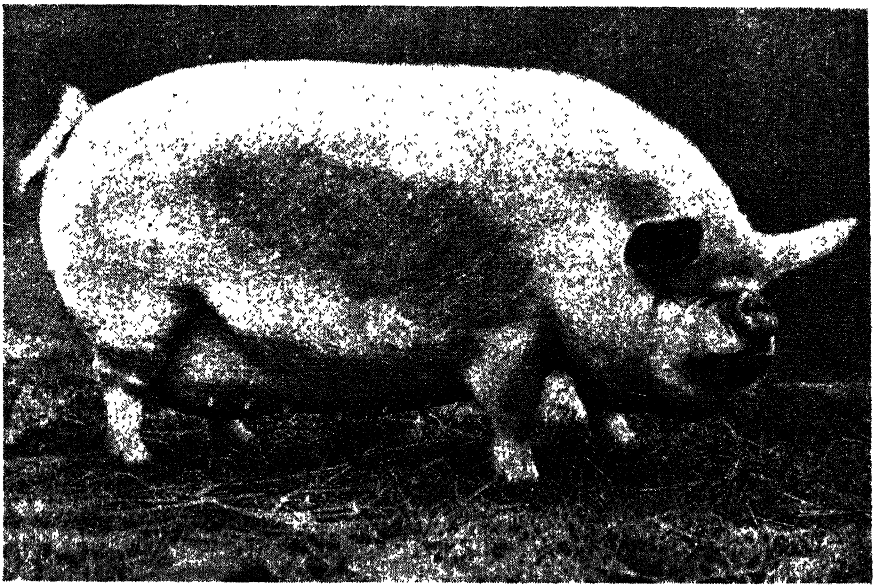


PLATE 154.—MIDDLE WHITE SOW.

This prize-winning Middle White sow protrays type, conformation, and quality, such as is sought for in this popular breed.

Mr. J. T. Eady reminds us in his interesting review of the breed in the 1934-35 Pig Breeders' Annual that so successful was Sanders Spencer that his herd won in five years 339 prizes amounting in cash to £1,400, and after an interval in the second five years, 401 prizes totalling £1,600, a reminder that there was plenty of money in pigs even as far back as the 'sixties. The success attending his efforts naturally spurred other breeders on, and in rapid succession came the development of such well known families as the Holywells, Histons, Pendleys, and Wharfedales, of whom representatives have on several occasions been imported to Australia. Mr. Eady also reminds us that

although Sanders Spencer has gone, the Middle White breed will remain a testimony to his life work, that will last for all time, and keep his memory evergreen. The Walton herd of the late Sir Gilbert Greenall played its part, and had a great influence on the breed, and was prominent for many years. Such names as "Walton Rose," "Walton Daisy," and "Walton Turk" occur and reoccur many times in the history of many Middle White families of to-day, so also does the Wharfedale Reveller family, Wharfedale Deliverance, and Pendley Choice. Prominent also was the late Leopold Paget, whose death only quite recently was a sad blow to this breed. Representatives of the Histon herd of Chivers & Son have had an important part in the breed's more recent history; in fact, one sow in particular, "Histon Lady Choice," sold for the English record price of 180 guineas some twenty years ago or so.

PLATE 155.

Champions at the Royal Show, Sydney, 1934, this pair of Middle Whites illustrates the type available here. The boar carries a heavy coat, and is somewhat coarse and curly in hair. The sow is more refined, and has a particularly well-developed set of udders.

Another breeder whose name is well worthy of a place in this list is Arthur Hiscock, whose family did a great deal to popularise the Middle White breed.

Prominent among the breeders who were interested in this breed in Australia in the early days of registration here are included: Mr. J. J. Baker; Dookie Agricultural College (Victoria); Hawkesbury Agricultural College and Gladesville Hospital (N.S.W.); Messrs. E. Jenkins, F. E. Kurrle, Chas. Jones, Peter Miller, Jno. Madden, S. A. Peck; Queensland Agricultural College, Gatton (Q.); Messrs. W. J. Warburton, and W. R. Robinson.

In those days the Large White had fewer followers than now, but it can be said in all fairness that the Middle White led the way in the earlier years of pig improvement in this country.

Special Qualifications of the Breed.

Fostered by the National Pig Breeders' Association in England, and the Australian Stud Pig Breeders' Society in Australia, the Middle White has gained for itself a place of importance in the pig industry.

The Middle White ranks with the best of other breeds, indeed it probably excels the others as a breed suited to the production of

porkers, for there is no quicker feeder than the Mid White for production at an early age of the light weight prime quality carcasses nowadays so much in demand locally and overseas. It is in addition an excellent butcher's pig, dressing out to advantage with a minimum of offal and an attractive, neat, lengthy carcass. With other breeds it has improved appreciably in its suitability for the production of baconers, the typical carcass having good length, depth, and a reasonable proportion of lean meat.

For porkers it approaches the ideal in the pure bred form. It is useful also for crossing with the Berkshire, while crosses with breeds like the Tamworth increases the proportion of lean meat and produces a light coloured animal much in demand; although in such a cross as the latter, care must be taken that the young pigs do not become too leggy and lean before being finished for market.

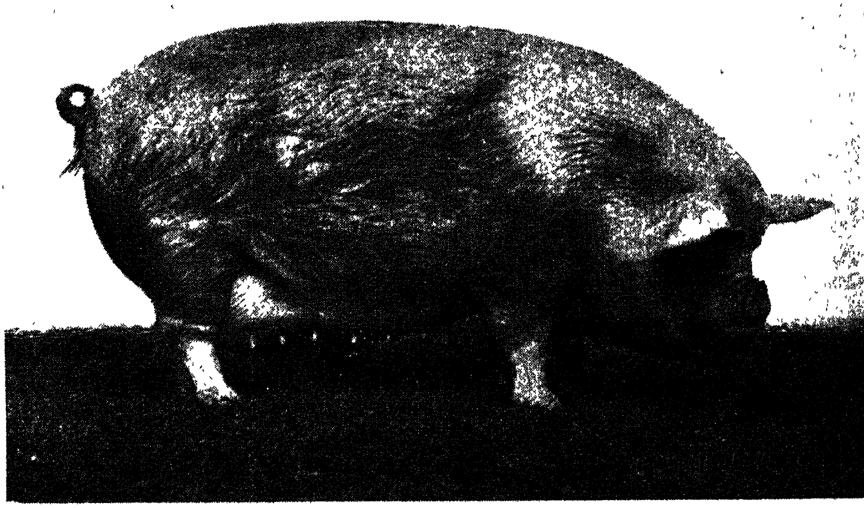


PLATE 156.

Though somewhat more compact and of blocky stature, this Middle White sow shows plenty of quality and is well developed and roomy in body, and has proved a profitable addition to her owner's herd.

The breed ranks high in prolificacy, 1,638 litters recorded in 1932 (in England) giving an average born per little of 9·55, with an average reared of 7·57, as against the Wessex Saddleback, which topped the list with a reared average of 8·12. The writer's experience is that, if given a reasonable chance and kept in medium breeding condition, the Middle White will easily eclipse the English figures under Australian conditions. A special characteristic of the Middle White is its docility, the sows in particular being exceptionally docile and careful with their young. They are liberal milkers, and the young pigs grow rapidly and are of attractive type at an early age, points of especial importance in preparation of stock for market. Being docile naturally indicates that the breed has an even temperament, and settles down quietly to its environment.

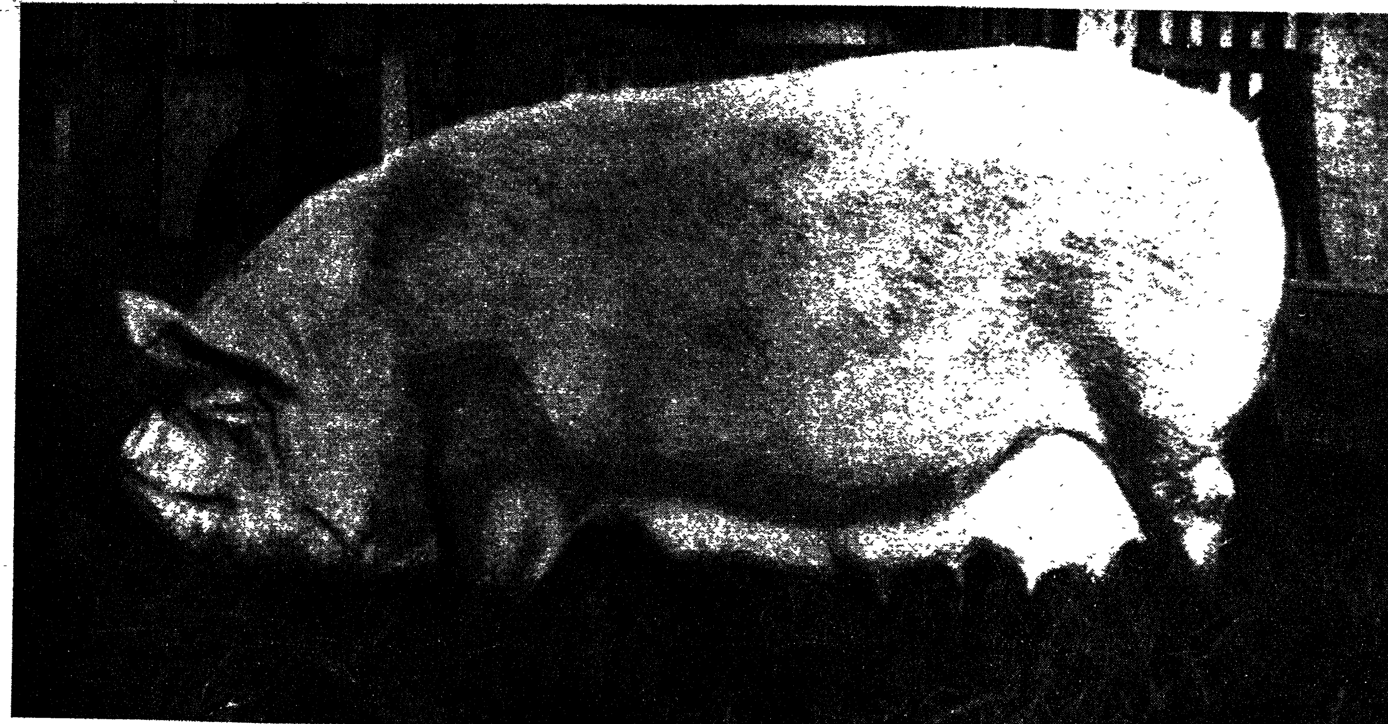


PLATE 157.

"Norfolk Poppy 3rd," 4609, Champion Middle White sow, Brisbane Exhibition, 1934. Shown by Mr. J. J. Slack. This sow is a daughter of the imported "Anport Fuchsia, 9th," 4192, a sow of excellent type and conformation with noted prize-winners in parentage. Note feminine characteristics and capacity to suckle and rear large thrifty litters.

Good constitution, a well developed heart girth, withal a light shouldered type, there is no reason why Middle Whites should not be suited to conditions on any farm. The fact that the breed is kept extensively under open air conditions in colder countries has proved its capacity as a grazing animal. Even in warmer climes it can stand up to extremes in temperature without undue distress—another evidence of its suitability for Australian conditions where open air systems of pig-raising are becoming more popular each year.

Breeders in Queensland who have tried the Middle White under these conditions report success. The late Mr. W. J. Warburton, of Northgate, had this breed for many years prior to the general adoption of a paddock system; so did the late Mr. W. R. Robinson, who claimed to have been the first to introduce this breed into this State.

In England many of the leading breeders keep their pigs out-of-doors throughout the year, even during winter months, with snow on the ground. In more recent years breeders like Messrs. Pope and Sons, of Nambour, Dinmore Stud Piggery, G. W. Winch, of Zillmere, and others have kept their Whites under a semi-intensive system, permitting the animals to remain in the open air as long as they wish, providing suitable shelter sheds or shade trees as required. Breeders in North Queensland, Messrs, J. E. Foxwell, W. J. Sloan, and others report similar success.

Early maturity is another special qualification of this breed; in fact, the National Pig Breeders' Association emphasise the breed's claim to distinction by its success in pork carcass competitions at Smithfield and Birmingham Fat Stock Shows. They state that the Middle White, in common with other breeds enjoying similar status, has proved itself to be an excellent pig for the farmer who prefers to crossbreed, and whose objective is early maturing pigs for the pork market.

The breed possesses prepotency by virtue of long continued registration and its suitability proved by many years of experience for mating with strains lacking in this respect. The breed can be used to advantage for crossing with pigs lacking the same qualifications, and where early maturity, trueness to type, and even conformation are desired; especially is this so in regard to the use of this breed in the production of uniform quality porkers for the frozen pork trade. The advantage the breed possesses in stamping its white colour on its progeny should not be overlooked in considering the selection of stock for use in this branch of the industry.

Refinement of quality is a goal towards which all pig raisers should aim, and in this direction much can be done by the use of a breed noted for its refinement and trueness to type.

Queensland experience indicates that the White breeds have come to stay, and that they can be used to advantage in the building-up of an expansive export trade.

The general recommendation of officers in the Pig Section of the Department of Agriculture and Stock is to use the Middle White boar where good type Berkshire, grade or first cross sows of similar type are available, and/or to use Middle White sows as matrons in the herd, and to use either a Middle White or a Berkshire boar. Some emphasis has been given to the value of the Middle White-Tamworth cross, and

the cross where sows carrying British Black blood are available. It is noteworthy that at the first of the series of annual carcass contests conducted by the Queensland Meat Industry Board, Middle White pigs or their crosses secured the premier awards.

If one point might be stressed more than another in dealing with the Middle White breed, it would be to urge the necessity for special attention in the selection of breeding stock to obtain lengthy deep-bodied pigs with a heavy coat of silky hair and with a pinkish skin free from blue or black spots or freckles as far as this is possible. Any strain showing a tendency to shortness and chubbiness of body and to overfatness should be discarded. Select only from large, thrifty litters, and be certain that both boar and sow, the latter particularly, have twelve, fourteen, or sixteen well-developed permanent teats evenly distributed along the belly line. Any indication of coarseness in bone, rupture, or other abnormalities in breeding organs or lack of sufficient hair to protect the skin should be guarded against. Selection of the proper type and their care and attention along approved lines will overcome any tendency this or the Large White breed may have to suffer as a result of the warm climate.

STANDARD OF EXCELLENCE

For the Middle White breed as adopted by the Australian Stud Pig Breeders' Society, 1934.

	Points.
Head and Ears—Short and light, wide between eyes and ears; face slightly dished; ears medium, carried erect or slightly forward, and fringed with fine hair	15
Neck and Shoulders—Medium length, evenly set on shoulders; jowl full, but not heavy; shoulders well sloped backward, and free from coarseness	10
Back and Sides—Long and straight; loin full; ribs well sprung, sides deep and full to flank, showing straight underline; and in sows, twelve good, evenly-placed teats	20
Hams—Broad, full, and meaty to hocks; tail set high, not coarse	20
Legs and Feet—Short, straight, and strong; feet firm and strong; hoofs nearly erect; action free and clean	15
Colour, Skin, and Hair—White, free from black spots; skin fine and free from wrinkles; hair long, plentiful, and fine and silky	10
Character—A combination of all the points showing distinctive breeding, type, and quality	10
	100

THE SMALL YORKSHIRE.

Many years ago the Small Yorkshire was prominently before breeders in the Homeland and in this country, but at the end of the nineteenth century this and several other breeds of similar type had lost ground and the Small York and the Small Black (often referred to in Australia in these days as the Black Essex) in particular have disappeared altogether, and nowadays are not bred to any extent in any part of the world.

The reason for their decline was their unsuitability for the warmer climatic conditions of Australia. Any advantage they possessed and the breed qualifications have been improved upon and commercialised in the Large and Middle White breeds, which in themselves have been bred more along commercial lines in recent years.

At the Brisbane Show.

NOTES ON THE PIG SECTION.

By E. J. SHELTON, H.D.A.

THAT the periodical introduction from countries overseas of fresh strains in the different breeds of pigs is productive of good needs no greater emphasis than mention of the success of imported stock at the recent Royal National Association's Exhibition at Brisbane, Queensland, at which there was a very comprehensive and valuable display of stud and commercial pigs. The judges in the stud pig classes were Mr. T. J. Collins, of the State Hospital, Newington, N.S.W., a man well versed particularly in the Berkshire breed; and Mr. A. F. Gray, New South Wales Government Instructor in Pig Raising.

Berkshires were prominently represented, and created a very favourable impression; in fact, the senior animals in this breed were almost without equal at any Australian Show.

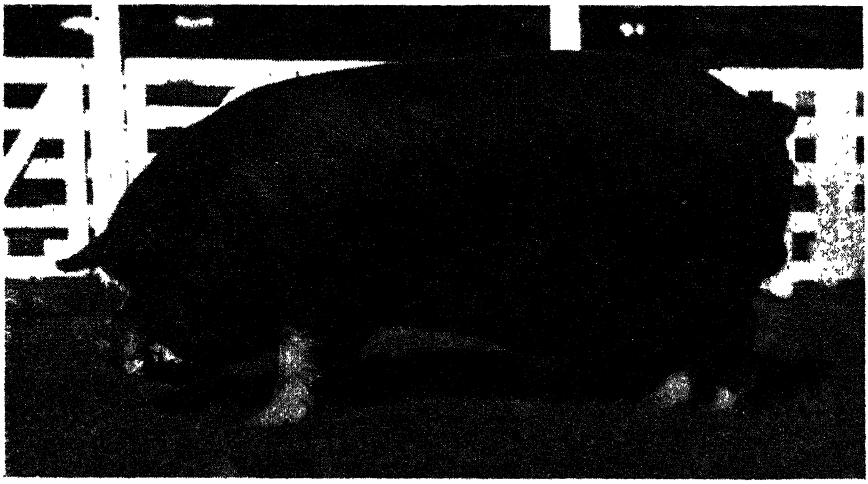


PLATE 158.

"Grafton Trump." Messrs. M. Porter and Sons' Reserve Champion Berkshire boar. R.N.A. Exhibition, Brisbane, 1934; also Championship winner, Wondai and Murgon. "Grafton Trump" was bred at Grafton Experiment Farm, New South Wales, from imported strains, is the sire of many Champions and prize-winners.

"Yanco Boscer," 11686, bred by the Riverina Welfare Farm, repeated his success at Sydney Royal, and carried off the breed championship and Herd Book ribbon. Since his purchase by Mr. J. Barkle for Queensland after last Sydney Show, he has secured championships at Toowoomba Royal (in keen competition there as well as at Brisbane), Oakey, Dalby, and Kingaroy, the only shows at which he was penned. This is a very fine son of "Navua Chamelion," having as his dam, "Yanco Beautiful." The reserve champion boar and last year's champion in same class was "Grafton Trump," 10722, owned by M. Porter and Sons, Wondai. This boar was bred at

Grafton Experiment Farm, and is a son imported in utero of "Pygmalion 5th," 10127, from "Highbury Fair Lady 2nd," 10126. He is a very fine representative of the latest British type.

A son of his, "Roselock Trumpet," 11374, bred by M. Porter and Sons, Wondai, and exhibited by the Wide Bay Stud Piggery, annexed the third award. He also has won championships at other shows, and like "Grafton Trump" is well known. The other ex-champions in the same class were "Caralulup Harry," 10020, bred in Victoria, and a champion at a number of Queensland Shows; "Goodna Aviator," shown by Goodna Hospital, and a prize winner of note; "Cawdor Happy Lad," 11603, champion at the recent Ipswich Show; and "Gatton Premier," who has worn prize ribbons on many occasions.

Several boars and sows were shown by Mr. F. Bach from his "Whipling Amelia 2nd" (imp.), 12103, and again brought forward imported strains of much value.

PLATE 159.

"Roselock Lila." Mr. Mat. Porter's prize-winning sow. Champion, Brisbane 1932; First and Reserve Champion, 1931. Reared litter of nine out of twelve. Exhibited Brisbane Exhibition, 1934. A fine type of breeding sow.

The imported sow, "Linton Patience," 12102, bred from "Bridge Poppy," 11504, and sired by "Hillsborough President," 3519, at the stud of S. C. Armitage, Linton Fields, England, secured the premier award in the female classes, and also first award in sow and litter class, in which there were several nice families. She secured the Herd Book ribbon, and in some measure repaid Mr. Bach for expense incurred in importing his two sows. "Whipling Amelia" secured first prize in a keenly competed class, and most of the breeders considered she should have been awarded the reserve, an honour that fell to Mr. O. L. Klein's entry, "Kapleton Dora," 11036. The Berkshire sows were a very fine lot. Last year's champion, Mr. Mat Porter's sow, "Roselock Tessie," was this time shown with a fine litter of twelve and secured second in that class, and third in the class for sows over 21 months. There

were approximately 175 Berkshire sows, and it was remarked there were no tail enders.

Large Whites.

The champion Large White boar, shown by Gatton College, again brought forward imported strains, for he, "Norfolk King David 5th," 1687, is a son of the imported "Wall King David 14th," 953, from that fine sow, "Spalding Baroness 11th" (imp.), 951. The reserve champion boar is a son of "Wall King David 48th" (imp), from Hon. T. H. Paynes' Woodburn Stud in Victoria, who imported several prominent animals from England. Other interstate studs represented among the prize winners included the Finchley and Vaucluse herds in Victoria, the Queensland Agricultural College and High School stud at Gatton, Queensland, in which there are also several stud animals from the Southern States, and the stud of J. A. Heading, of Murgon. Mr. Heading has New Zealand strains in addition to those from Victoria; in fact "Pine Terrace Pear" (imp.), 1220, carrying Canadian blood, annexed the female championship and Herd Book ribbon, while the

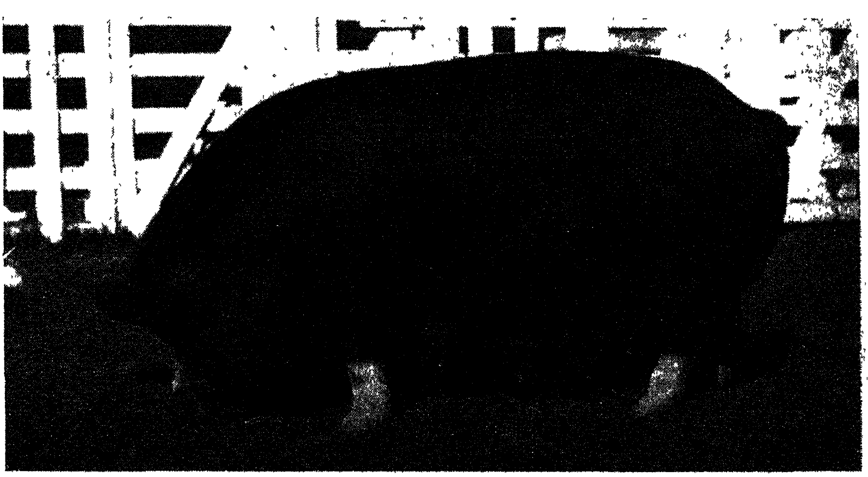


PLATE 160.

"Roselock Tessie." First and Champion R.N.A., Brisbane, 1933; third prize winner, 1934. Second prize with litter of twelve, Brisbane, 1934. First Wondai, second Murgon, and Maryborough, 1934. A classy sow and a proved mother. Owner, M. Porter and Sons, Roselock, Wondai.

reserve champion is a granddaughter of imported parents. "Norfolk Bonetta 4th," 2011, another daughter of the imported "Wall King David 14th," carried off first prize in her class with litter. A daughter of "Spalding Superior 21st" (imp.), 2098, by "Tockwith Prince George 37th," 77923, was a very close runner-up for first place in her particular class. Approximately 90 Large Whites were penned, easily the largest and most exemplary display of stud animals in this breed yet penned north of Sydney.

Middle Whites.

The progeny of imported blood secured the five principal awards in the Middle White breed, the champion boar, "Norfolk Defiance 3rd," 4596, a son of that grand old boar, "Norfolk Nobleman," 3993 (last year's champion) ex "Norfolk Fuchsia 2nd," 4407, being a typical

illustration. He was shown by Mr. J. J. Slack. The entry of Mr. G. W. Winch, "Ferndale Victor," 4807, from the stud of I. M. Cash and Sons, in Victoria, secured the place of reserve and second in the aged class, and is a son of "Dookie Moral," from "Ferndale Pearl," a prize winner of note, like her sire and his stud. Mr. J. J. Winterbottom's stud secured a place with a boar penned by Mr. J. J. Slack. This boar was first in his class at Sydney, and had to face even keener competition at Brisbane, where he had to be content with third place. Mr. Cash's stud was represented also in other classes. Mr. Charlish's stud came in for much comment when "Norfolk Poppy 3rd," 4609, won the championship and Association's ribbon. She is a daughter of "Amport Fuchsia 9th" (imp.), 4182, and had as a very close runner-up the reserve sow, "Norfolk Bonnie 1st," 4588, a daughter of "Pendley Deliverance" (imp), 4190, an imported sire who has done much for the breed in this country.

Queensland urgently needs fresh strains, however, in this and the Large White breed, in order to maintain type and conformation and keep the breed up to its highest standard. The showing of Middle Whites was the best staged at Brisbane for at least fifteen years, and indicates the progress being made. It is of additional interest to note that a boar offered for sale by Mr. Cash realised highest price at the sales, 22½ guineas, and a sow sold by Mr. J. J. Slack at 19 guineas topped the prices for sows in all breeds offered.

Tamworths.

Mr. A. F. Gray judged the Tamworths, Wessex Saddleback, and Middle Whites, while Mr. Collins handled the Berkshires and Large Whites. Mr. M. Moffatt, of Billinudgell, annexed the male championship in this breed with a son of that very fine imported sire, "Whittingham Red Start," 1366, the boar being bred at Wollongbar Experiment Farm, New South Wales. It would be but fair to say that these imported strains have exercised a very considerable influence for good in the pig-raising industry in Australia, especially as the bulk of our prize-winners carry imported blood in their veins, and most of it imported within the last ten or twelve years.

"Wattledale Sandy," shown by Mr. J. Barkle, won a very well-merited reserve ribbon; in fact, he was quite good enough for the premier award, and in much better breeding condition, although the champion was in better form in that respect at this than at former shows. A son of "Milton Luck 3rd," imported from "Berkswell Constance 15th" (imp.), 1798, shown by Mr. H. B. Kerner, was placed.

That "Berkswell Constance 15th" (imp) is a good importation is again proved by the fact that her daughter, "Warringal Precocious," 1924, sired by "Milton Luck 3rd," won the championship in female classes, and was generally regarded as the best sow that has yet been shown in this breed at any Australian Show. Mr. Barkle also secured the reserve Tamworth sow championship with his "Wattledale Queen," sired by "Glenburra Bill," a champion of former days. "Warringal Carnation," 2159, a daughter of "Berkswell Constance" by "Baulking Golden King" (imp.), 1800, was also penned. There were approximately 80 Tamworths penned, comprising a very attractive selection, and emphasising that we have in Australia some of the best Tamworths in the world.

Wessex Saddlebacks.

Imported strains again came to the fore in this recently imported breed, the champion sow being "Holmsleigh Ace" (imp.), 2, bred by H. Losmore, of Devon, England. A son of hers, sired by "Holmsleigh Pioneer" (imp.), 1, secured the championship in the male classes, while progeny of these and others annexed important awards, the imported sire, "Holmsleigh Surprise" (imp.), 10, being runner-up for championship, and "Maiden Beech Ringouzel 9th" (imp.) annexing that position in the female classes. Although sons and daughters of these imported parents were shown in larger numbers than at former shows, there is as yet an insufficient number of animals available in this breed to enable it to make much progress or to demonstrate its capacity to produce and rear large litters. Mrs. A. Alford, Mr. R. Turpin, and Mr. C. F. Marshall were the only exhibitors.

Further comments and pictures of prize winners in the Pig Section will be published in the next issue of this Journal.

A GATE THAT WILL NOT SAG.

A Southern farmer supplies an agricultural paper with this splendid idea for a gate that will not sag. Thus he writes:—"Before sawn timber got plentiful in the backblocks, various were the styles of gates. Every owner seemed to have a different style, and some of them were very ingenious. Where timber is plentiful, and particularly in the mulga country, the following, I think, will be useful:—

"Cut a limb or two with a protruding fork in the following shape:—

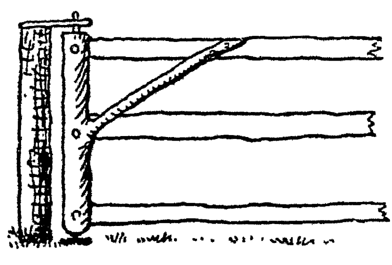


PLATE 161.

"It will easily be seen that the fork, being part and parcel of the post, it would be impossible for it to sag. In any road gates I have always used 3 by 1 timber and rabbit netting. Use of the latter saves a lot of weight, and can be easily put in between the battens, which are held together by bolts. I put up a set of drafting yards in the Cunnamulla district in Queensland and, of course, there were the usual number of small gates, and I found this style very effective."

The 1934 Brisbane Exhibition.

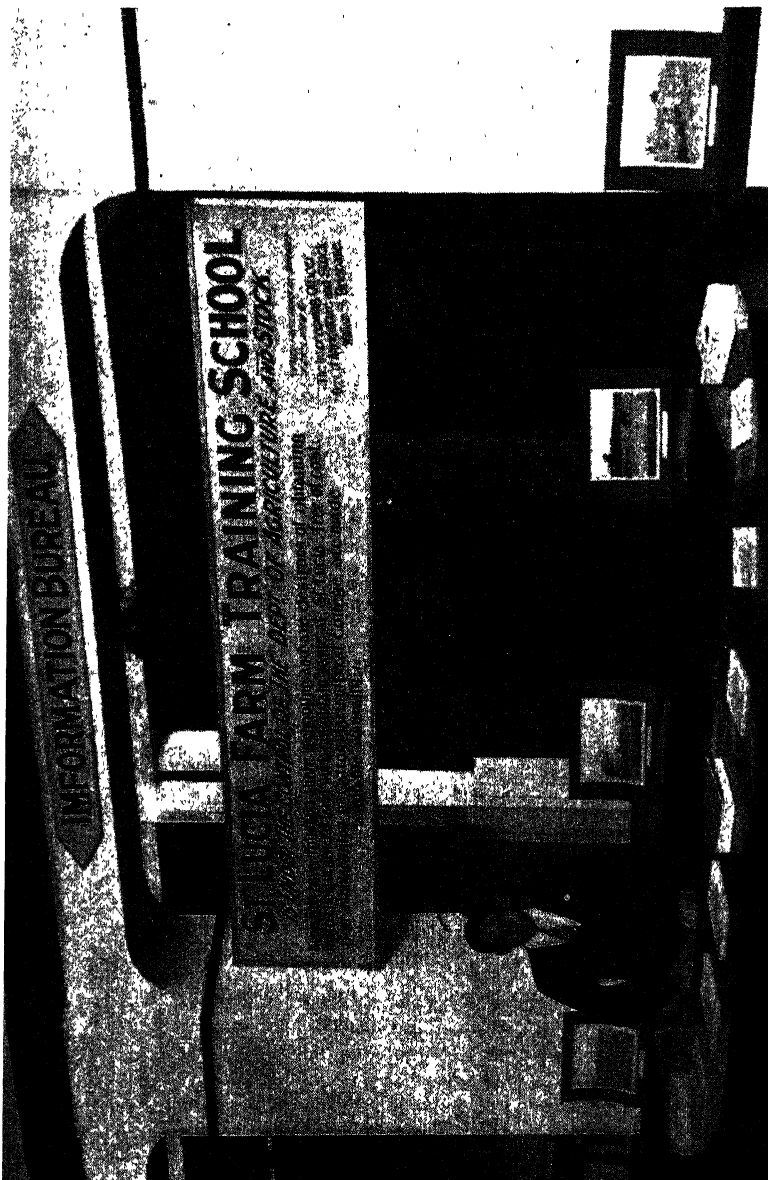


PLATE 162.—THE JOURNAL AT THE SHOW.

The "Q.A.J." Information Bureau in the Agricultural Court at the Brisbane Show was the distributing centre of information on Departmental activities—a service much appreciated by farmers visiting the Exhibition. Mr. A. C. Boyle is the young officer in charge.

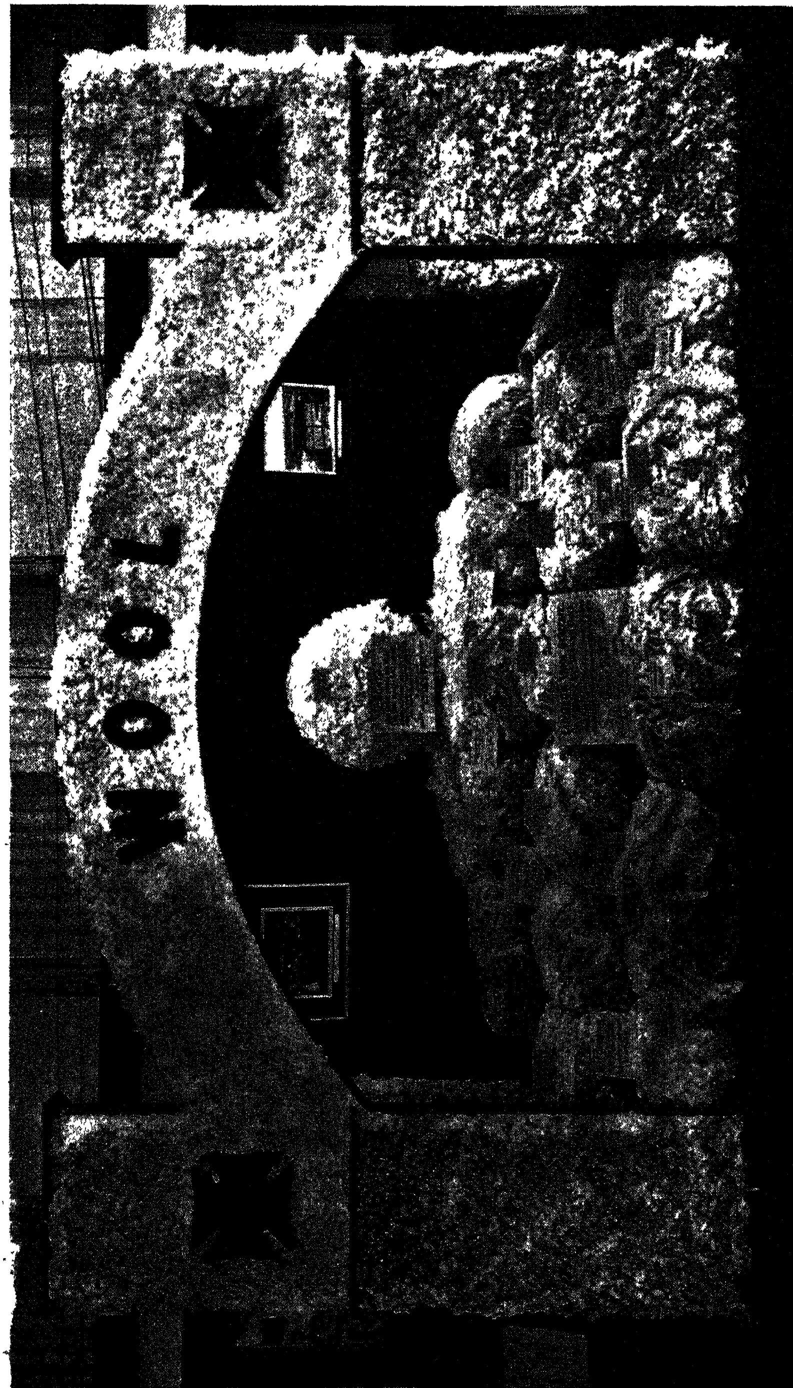


PLATE 163.—A FLEECY EMBLEM OF OUR WEALTH IN WOOL.
Queensland's fine merino wools are unexcelled in any other country.

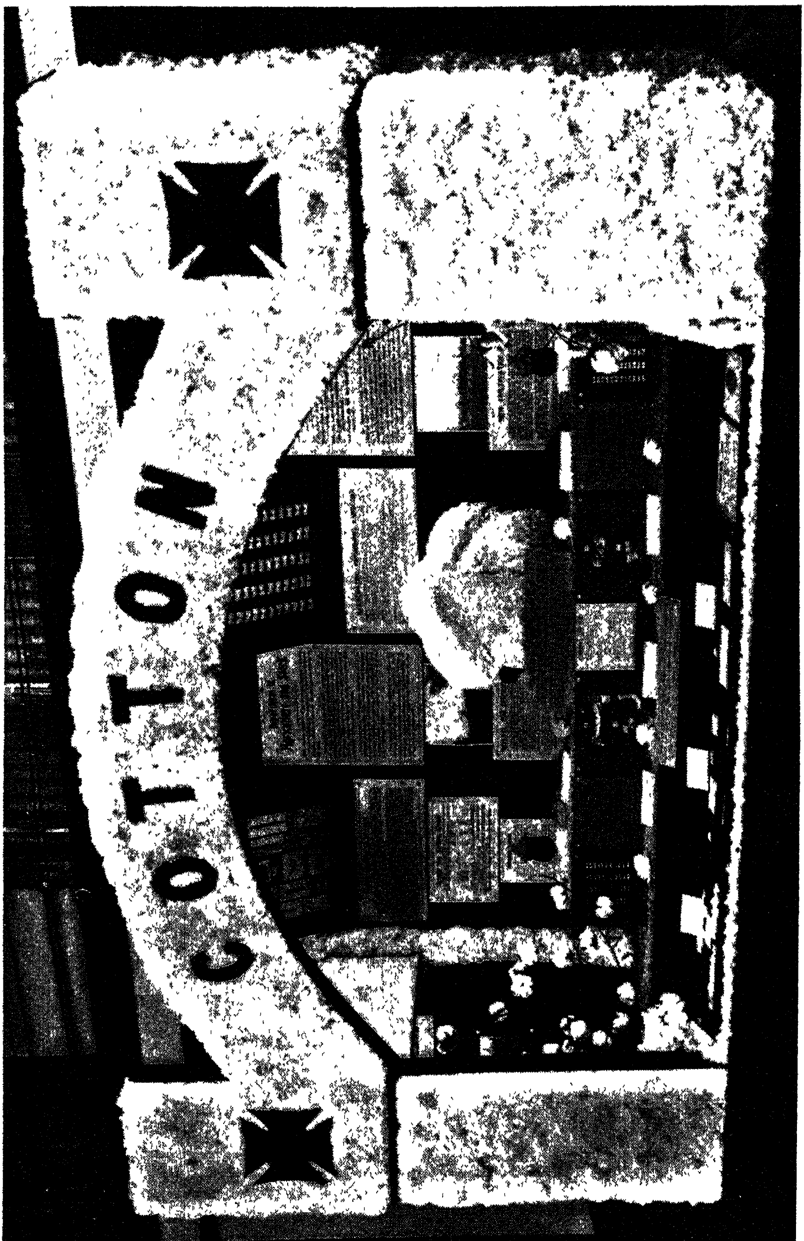


PLATE 164.—QUEENSLAND LINT FOR AUSTRALIAN LOOMS.
Cotton-growing is developing into an industry of major importance, and the spinning industry is already an appreciable factor in the economy of the Commonwealth.

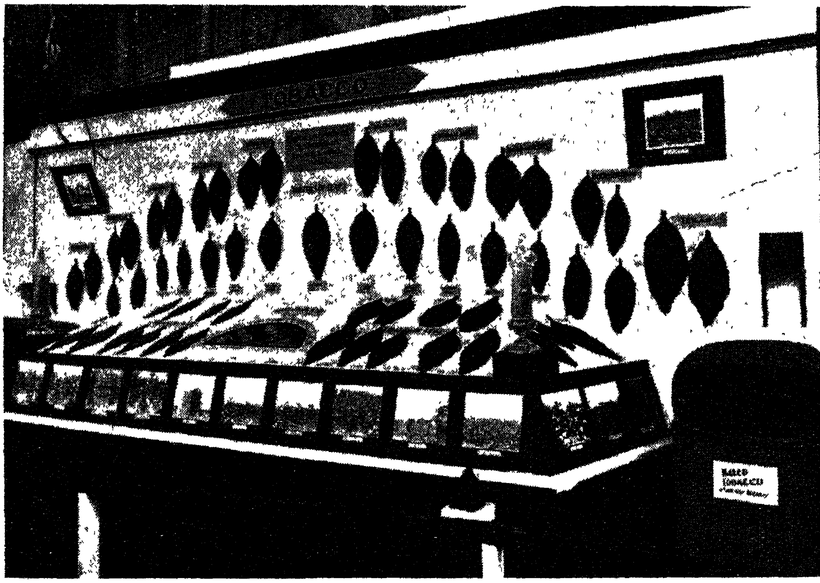
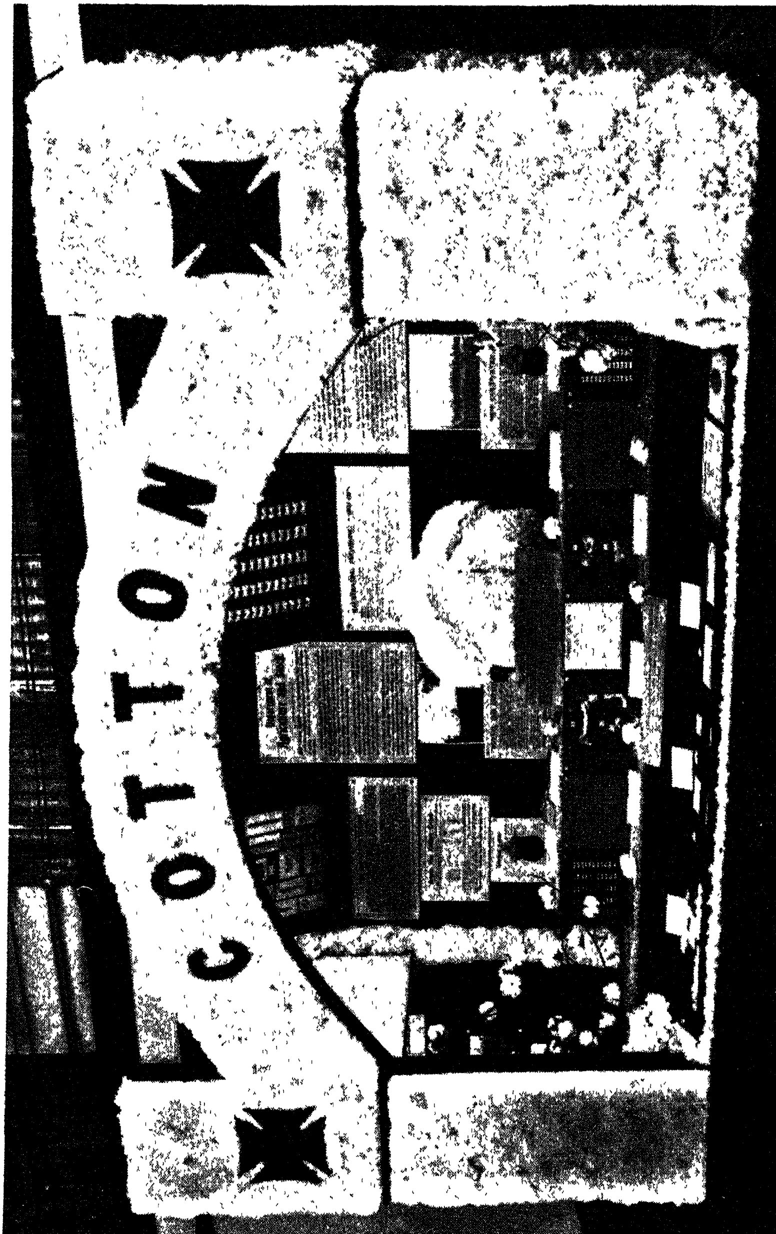


PLATE 165.—QUEENSLAND GROWN TOBACCO AT THE BRISBANE SHOW.

This display of leaf from the State's tobacco lands was definite proof of their capacity to produce high quality tobacco acceptable to manufacturer and consumer alike.

PLATE 166.

The Queensland tobacco grower is well served by the Science Branch of the Department of Agriculture and Stock.



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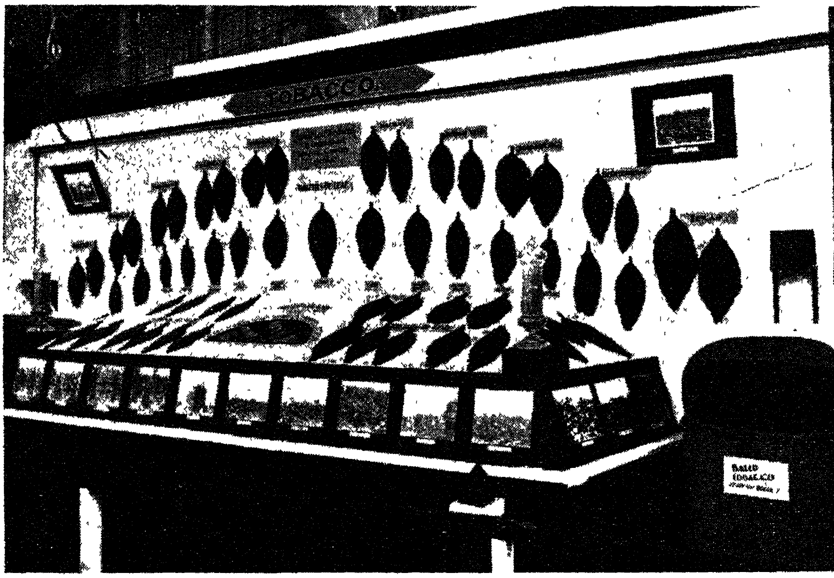

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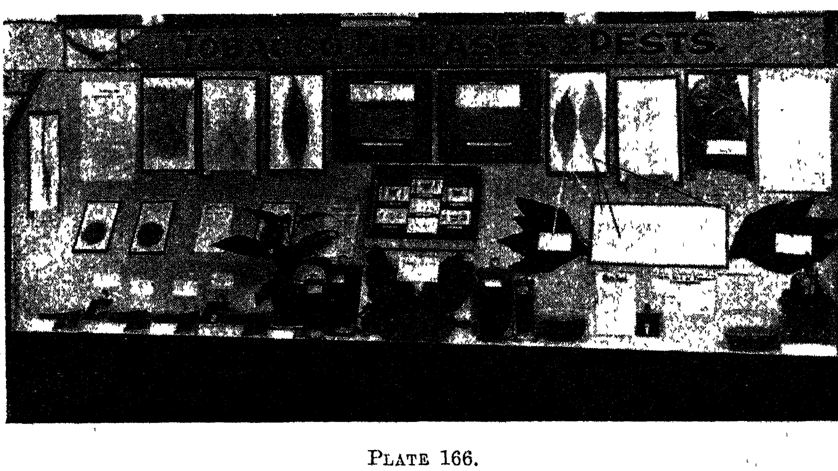


PLATE 166.
The Queensland tobacco grower is well served by the Science Branch of the Department of Agriculture and Stock.

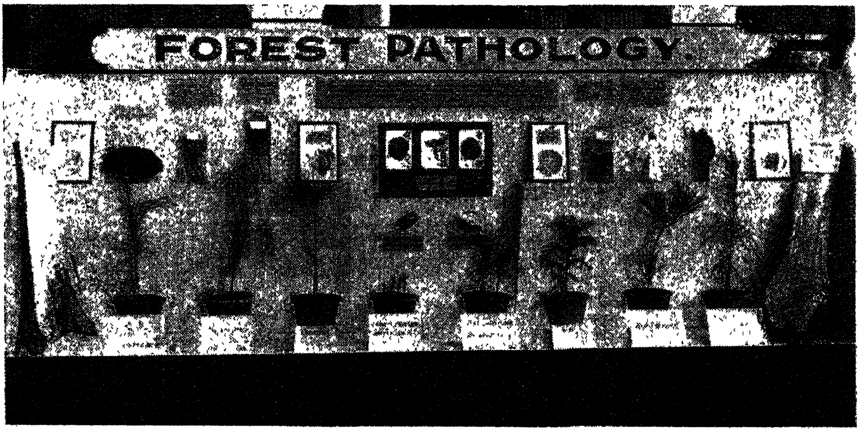


PLATE 167.
An Instructive Panel in the Departmental Court.

PLATE 168.—THE SUGAR BAY IN THE AGRICULTURAL COURT.

Our photographer found it difficult to get an effective picture of this fine exhibit, arranged by the Bureau of Sugar Experiment Stations in conjunction with the canegrowers' and sugar producers' organisations. In the centre section a scale-working model of a mill attracted crowds daily throughout Show Week.

PLATE 169.—AN IMPRESSIVE PANEL OF THE SUGAR EXHIBIT.

In the foreground is a model refinery on a river frontage with wharf stacked with sugar bagged for shipment. A diorama forms the background on which is depicted the spires, domes, and factory chimneys of a great city, to the wealth of which the sugar industry is an important contributor. The panel is also suggestive of the interlocked relationship of rural and urban enterprise.

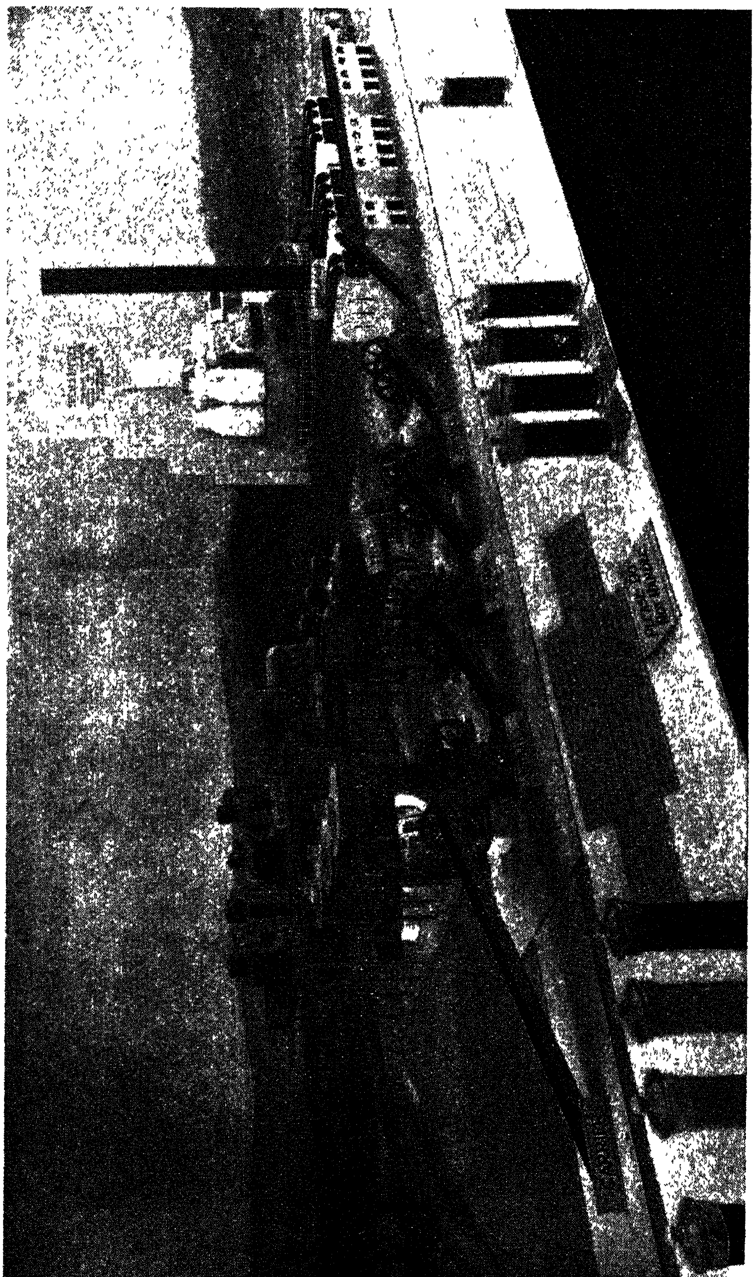


PLATE 170.—A WORKING MODEL OF A QUEENSLAND SUGAR MILL.

This model, constructed to scale and showing every factory operation in miniature, was the centre of keen public interest throughout Show Week. In this and adjoining sections the whole story of sugar was illustrated, beginning with the standing jungle and passing through every phase of farming, to milling and finally to the refinery and bagged and stacked sugar for shipment at the waterside.

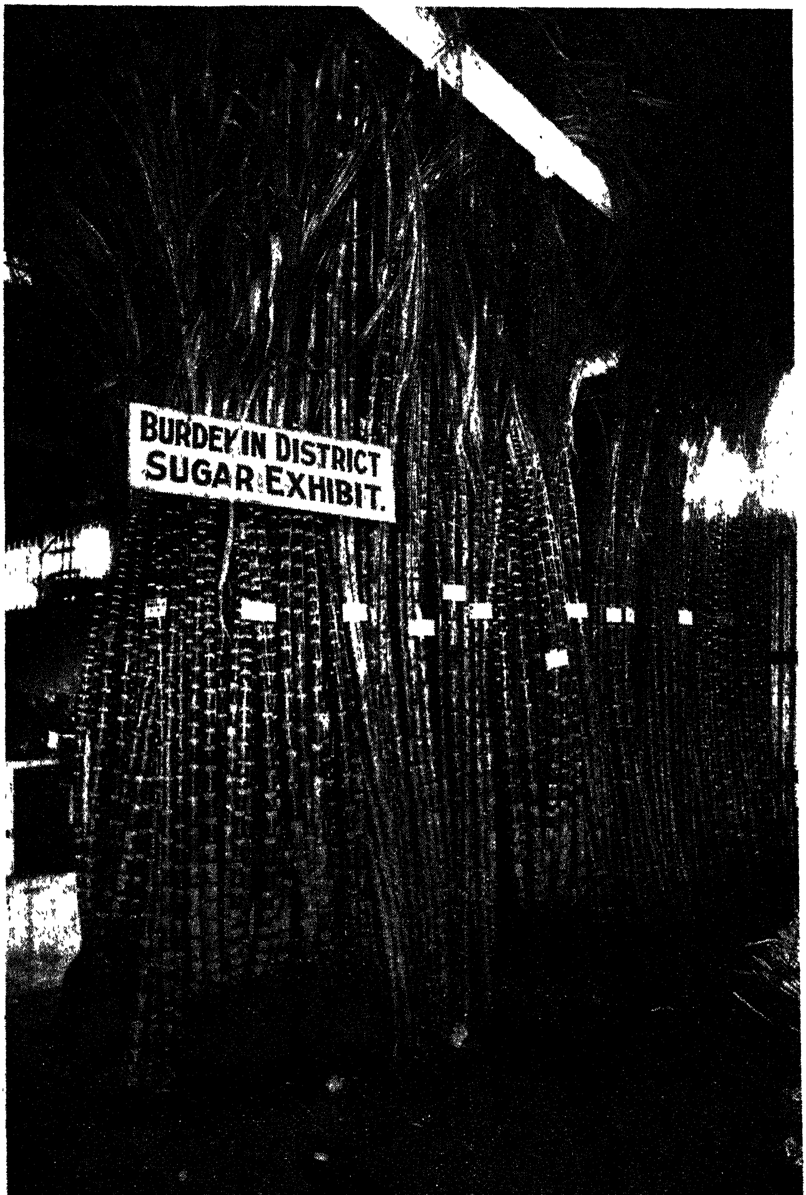


Plate 171.—Sugar at the Show.

These stools of standard cane varieties, grown in the Burdekin Delta, attracted keen interest at the Brisbane Show.

PLATE 172.—A CEREAL STORY IN SHEAVES AND GRAIN.

This interesting panel in the Departmental Court illustrated the success of the plant breeders' efforts to evolve a wheat suitable for Queensland's climatic conditions of summer rainfall.

PLATE 173.—QUEENSLAND MAIZE.

This display at the Brisbane Show was an impressive object lesson in maize-breeding and production in this State. It represented the national value of the work of Departmental plant breeders in the evolution and fixation of types that have quadrupled our grain yield. Maize-growing is now one of Queensland's major agricultural industries.

PLATE 174.—ALL FLESH IS GRASS.

These samples of Queensland pastures panelled in the Agricultural Court at the Brisbane Show illustrate the extensive range of nutritious indigenous grasses and herbage from which is derived most of the wealth of the State.

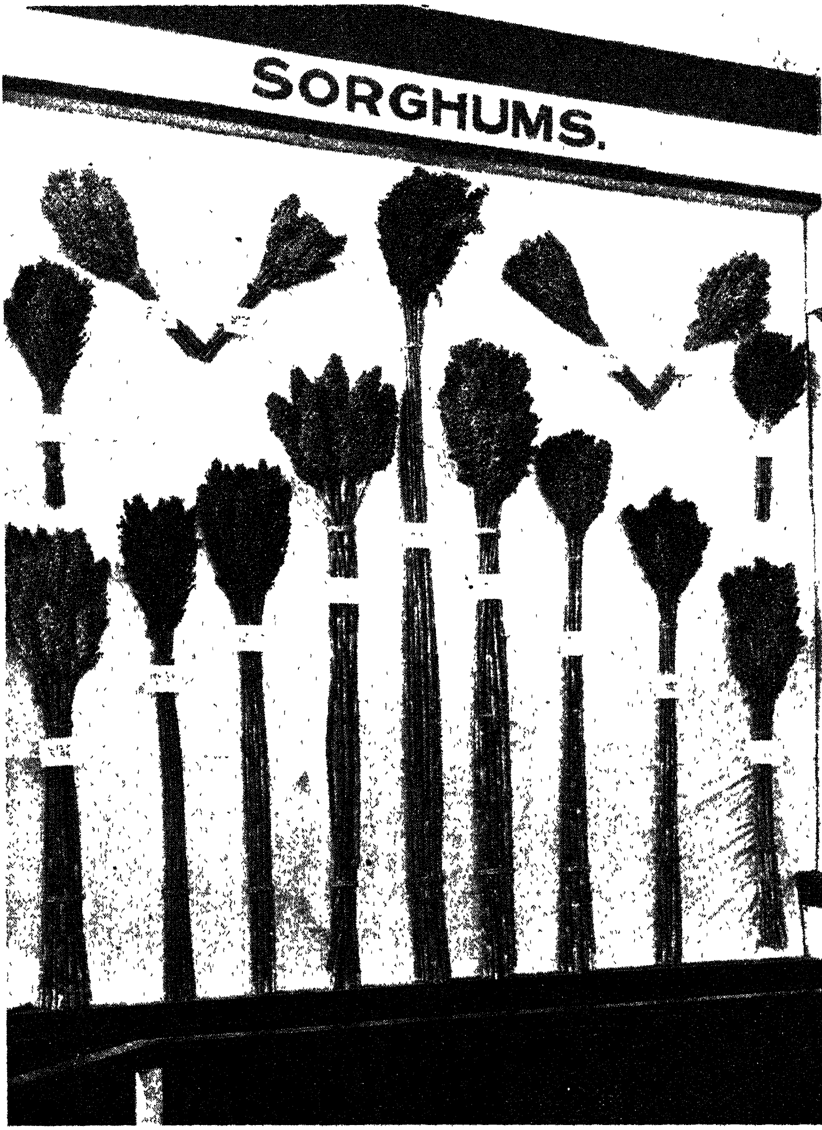


Plate 175.—Fodder Plants Panelled in the Agricultural Court.

PLATE 176.—IMPORTANCE OF PATHOLOGICAL RESEARCH DEMONSTRATED.

The Animal Health Station is controlled by the Department of Agriculture and Stock, with the assistance of an advisory board consisting of representatives of the Department, the Queensland University, the Council for Scientific and Industrial Research, the medical profession, and farming interests.

PLATE 177.—SCIENCE AND AGRICULTURE.

This and other exhibits of the Entomological Branch and its Pathological Section was illustrative of the extent and value of the scientific services available to Queensland farmers.

PLATE 178.—FRUITS OF THE CENTRAL BURNETT.

While both temperate and sub-tropical fruits are produced prolifically in the Gayndah District, its citrus groves have won for it the great reputation it enjoys on the markets of the Commonwealth as a great fruit growing region. This exhibit was awarded first prize in the Citrus Fruits Section with a score of 86¾ points.

PLATE 179.—APPLES FROM THE FRUITFUL GRANITE.

This was the winning exhibit in the apple trophy (20 to 25 cases) class at the Brisbane Show, grown by Mr. C. J. Doyle, near Stanthorpe. The fruit was in excellent condition, competing successfully against exhibits of Jonathans, Sturmers, and Democrats from New South Wales and Tasmania.

PLATE 180.—THE WEALTH OF QUEENSLAND'S TROPICAL PROVINCES.

The producers of the Charters Towers and Mackay Districts combined in presenting this remarkable array of the products of tropical coast and temperate tableland. No finer evidence of the richness of North Queensland in agricultural, pastoral, and mineral resources could be submitted. This exhibit won the "A" Grade District Competition.

Plate 181.—The Wealth of West Moreton.

The winning display in the "B" Grade District Competition at the Brisbane Show. This remarkable exhibition of the products of field, mine, and factory from one of the richest provinces in Queensland, and of which only a portion came within camera focus, was one of the most popular pavillion features.

Marketing Oranges at Home and Abroad.

By JAS. H. GREGORY, Instructor in Fruit Packing.

(*Continued from page 132, Vol. XLII., Part 1—July.*)

PART III.

PACKING THE EXPORT CITRUS CASE.

THE Export Citrus Case (24 inches long by 11½ inches wide by 11½ inches deep clear of partition) is made up with a partition, there being two compartments, each with internal dimensions 12 inches by 11½ inches by 11½ inches. The following packing table is used, the packs being given for one compartment only, the total representing the quantity in the completed two compartments:—

Approx. Size.	Pack.	Layer Count.	No. of Layers.	Total.
2½	3—3	4 x 4	6	288
	3—3	4 x 3	6	252
2¾	3—3	3 x 3	6	216
	3—2	4 x 4	5	200
3	3—2	4 x 3	5	176
	3—2	3 x 3	5	150
3¼	3—2	3 x 2	5	126
	2—2	4 x 3	4	112
	2—2	3 x 3	4	96
	2—2	3 x 2	4	80

Care should be taken to pack each compartment with the fruit at the ends of the case almost level with the top of the end, whilst the fruit is up to 2 inches in height in the centre at the partition. This gives a natural bulge for the lid of about 1½ inches in the centre when nailed. A cardboard guard for the fruit is placed over the partition to assist in keeping the fruit from being damaged by the rough edges of the partition board.

Width of Boards in Made-up Case.—The boards of the sides, tops, and bottoms should not be more than half an inch apart when nailed on. Enough space should be allowed to permit free ventilation of the cold air through the case. The following is the size of timber necessary to make up the case:—

Ends and Centre Piece—Three pieces 11½ inches wide by 11½ inches deep by ¾ inch thick.

Sides and Bottoms—Six pieces 26¼ inches long by 5¼ inches wide by $\frac{5}{16}$ inch thick.

Lids—Two pieces 26¾ inches long by 5¼ inches wide by $\frac{3}{16}$ inch thick. The lid is made longer than the sides to permit the bulge.

Cleats—Two pieces 11½ inches long by ¾ inch wide by $\frac{3}{16}$ inch. thick.

Packers observing the following rules should have no difficulty in obtaining good results with their packing.

1. To ensure protection from stalk marks when packing, all fruit should be placed on the cheeks, facing end to end in the case, so that the stalks are then resting in the pockets.

2. Reverse the last line of oranges in each layer.

3. See that all fruit appears in straight lines from end to end in the case, across and diagonally.

4. No two oranges must rest directly one upon the other, but in the pockets of the layer beneath.

5. The size of the pockets governs the height of fruit in the case.

6. Do not use, unless absolutely necessary, any of the intermediate counts in Tables "B" and "D."

7. Reject all blemished or damaged fruit—"If in doubt, throw it out" is a good maxim. Make a second grade for blemished fruit.

In conjunction with the rules for packing, growers should observe the following rules whilst handling:—

1. Use gloves for all operations when packing for export. One glove only need be used, being on the hand handling the fruit.

2. Clip all fruit with the special commercial type of blunt-nosed citrus clipper, and on no account pull fruit from the trees. Don't use unsuitable clippers, such as scissors.

3. Where necessary make a second cut to remove any surplus stalk left on the fruit after removal from the tree. It is preferable to make two cuts and do the work properly.

4. Do not harvest fruit in damp, humid weather.

5. Transfer by hand fruit from one container to another whilst picking, sizing, &c.; do not roll or tip fruit.

6. See that all handling receptacles and machinery have no projections, screws, or splinters, of any kind that would be likely to injure the fruit.

7. Sweat all fruit before packing; this will ensure tight packs on arrival at the market.

8. Do not leave old, decaying fruit lying about the packing house or in cases, &c., used in the handling of the fruit.

9. Spray the sizing machine daily with a 1 in 20 solution of formalin; sheds, particularly floors, should be cleaned and sprayed regularly once a month; if export packing for overseas markets, the sheds should be sprayed weekly.

10. Do not sit or stand on cases of fruit when carting or handling, drive fast over rough roads, or stack carelessly on carts, trucks, &c.

11. Do not pack dirty fruit or fruit picked from the limbs near the ground.

12. For preference do not use picking bags. A proper picking bucket is better for careful handling.

13. Do not pack sour, immature fruit; it will only spoil the sales of the following consignments.

14. Take care to place battens under the case ends when nailing down cases.

15. When packing for overseas markets do not send too large or too small oranges away; counts 126 to 216 give a good range of sizes.

General Notes.

Sweating.—Before packing for export, oranges should be thoroughly sweated or cured by being harvested and stored in a cool place for five to ten days, according to the state of the weather, temperature, and ripeness of the fruit. This is necessary to overcome the shrinkage that is often experienced when fresh fruit is packed and sent to local market and remains unsold for a few days. Whilst the sweating of fruit is not absolutely necessary when growers are near their local market, nothing is lost if the fruit is held for two days before packing, the longer period up to ten days being necessary when sending long distances. Sweating is often of assistance also in eliminating fruit fly and otherwise damaged fruit.

Wiring.—It is recommended that all cases of first-grade fruit be wired. Care should be taken to wire the cases correctly. The wire should be placed around the case about a quarter of an inch inside from the inside edge of the case end. It is essential that wires be not placed around the middle of the case where the fruit will be squeezed when tension is placed on the wire. A machine is obtainable commercially which carries out this operation quickly and efficiently. Many country-order buyers pay a little extra and give preference to purchasing wired cases, as it saves them time and money when they can secure cases ready wired for long-distance transport. It can be seen from this that wiring can be a help in giving a sales preference to a grower's fruit on a slow market.

Case "Get-up."

Labels.—Having taken care in packing, growers should complete a good job by giving careful attention to the outside appearance of the finished case. A well-chosen fancy label is an attraction and an asset, being a cheap advertising medium, the average coloured label costing very little. Growers not marketing fruit in sufficient quantity to warrant an outlay on labels may still make their cases look attractive by neat stencilling. Where growers as individuals are not in the position to obtain labels, an economical means of obtaining the use of a label is for a number to join together and obtain a designed label with a common district brand design, only the grower's name and address (which could be added by rubber stamp) differing on each grower's label. This enables a quantity of labels to be procured, thus cheapening the cost. A label must have the grower's or packer's (i.e., packing house) name or brand and address, the address to include the word "Australia" in ½ inch letters. Spaces should also be left to include the variety, number or size of fruit, and grade standard; rubber stamps can be procured to insert these particulars after packing. It is recommended to brand on the label the count in preference to the size.

Good flour paste is satisfactory for applying labels. The paste is applied to half a dozen case ends at a time. The labels, which are soaked in a can of water, are drained and given an application of paste on their backs, placed on the pasted ends, and gently rubbed with a damp rag. A satisfactory paste is made from flour as follows:—Take 1 lb. flour, ½ oz. alum, and 1 pint water. Mix into a thick paste and then add boiling water until the paste thickens, stirring all the time. If too much boiling water is added, making the paste too thin, boil slowly, adding a little more flour. If to be used immediately the paste can be made without the alum or by adding a small quantity of bluestone as a preservative can be kept for short periods.

Stencilling.—If using stencils only and marketing in Queensland, under the Fruit and Vegetables Act it is necessary for the packer to brand his initials, name and address, legibly and durably within a space measuring not less than 5 inches long by 2 inches wide. The name of the variety of fruit and the size or count must also be branded in letters of not less than half an inch in height. When sending overseas the word "Australia" must be included in the address.

Branding.—Cases should be branded so that as little confusion as possible is caused to loaders and checkers during transit. A good system is to brand as follows:—

One End—Shipping or Agent's Number.

Examples:

(Export)	(Local)
409 LONDON	W.A. 12 BRIS.

Other End—Grower's name and address, Variety, Number, and Grade.

Example:

J. JONES,
Palmwoods,
Queensland,
AUSTRALIA.
SPECIAL
W. NAVELS 126

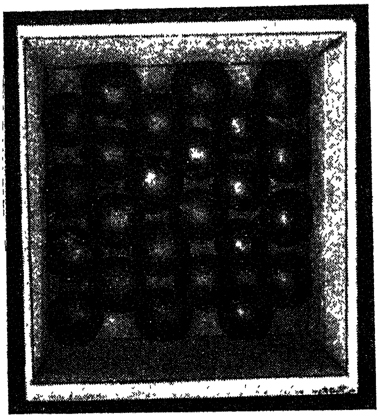
(Export or Local Market)

Good branding should be neat and should not show stencil ink smudges from running the brush over the edges of the stencil plate; make your stencils with a good margin around the lettering.

As the whole basis of successful marketing is care, growers should follow this principle right to the finish of their share of handling. Remember! Good packing, fancy labels, wiring, or stencilling will not sell bad fruit! All the care taken in putting up a first-grade, attractive package will be of no avail if growers, while carting the fruit to the station and loading into the trucks, do not handle it carefully. Too often we see carters sitting in the middle of packed cases of fruit while on the road, or walking all over packed cases whilst loading into railway trucks. Even good packing will not stand abuse, and so, in closing, every grower, carter, &c., is urged to handle the fruit from the tree to the consumer in the same manner as he would handle any delicate thing entrusted to his care. This should then enable us to get that return for which we strive for twelve months in and out of the orchard.

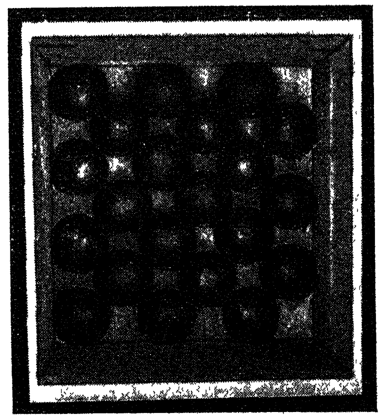
CITRUS EXPORT CASE.

First Layer.
3-3 Pack, 4 x 4 Layer Count.
6 Layers = 288.



Total, 288.

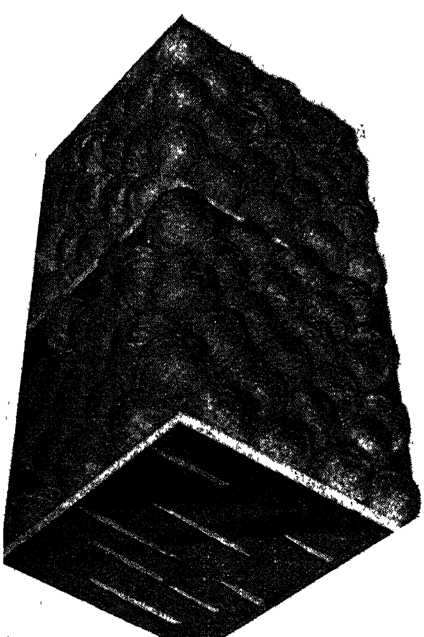
First Layer.
3-3 Pack, 4 x 3 Layer Count.
6 Layers = 252.



Total, 252.

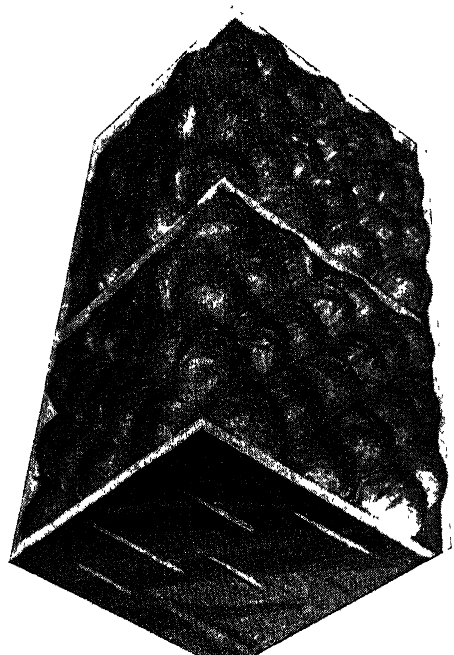
NOTE.—These first layers only represent a single compartment of the case. Each complete case contains two compartments which must be packed uniformly to obtain the correct count.

Finished Case.
Side. Top.



3-3 Pack, 288 Count.

Finished Case.
Side. Top.

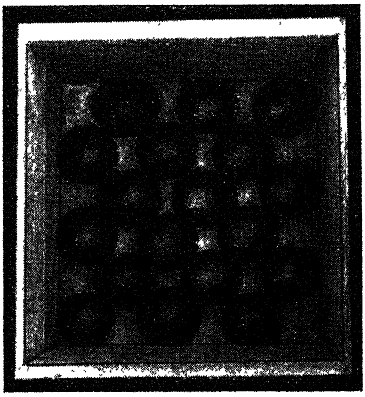


3-3 Pack, 252 Count.

PLATE 182.

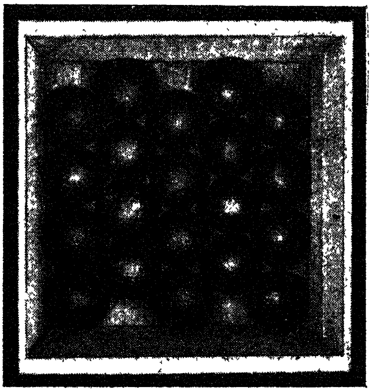
CITRUS EXPORT CASE—*continued.*

First Layer.
3-3 Pack, 3 x 3 Layer Count.
6 Layers = 216.



Total, 216.

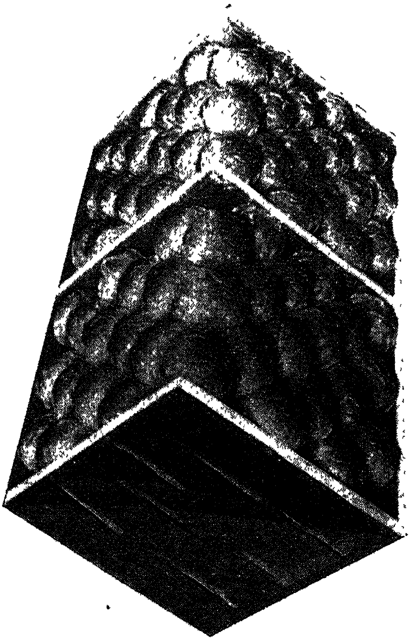
First Layer.
3-2 Pack, 4 x 4 Layer Count.
5 Layers = 200.



Total, 200.

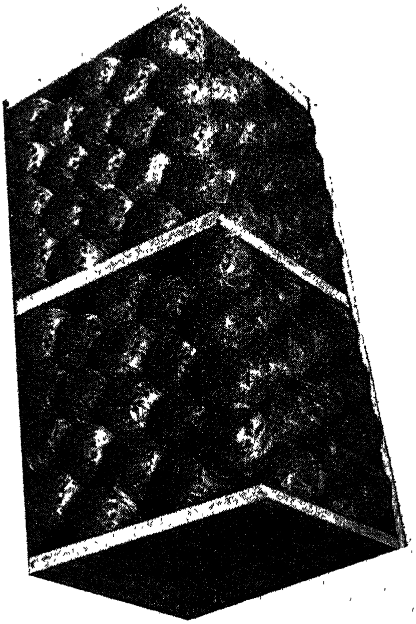
NOTE.—These first layers only represent a single compartment of the case. Each complete case contains two compartments which must be packed uniformly to obtain the correct count.

Finished Case.
Side. Top.



3-3 Pack, 216 Count.

Finished Case.
Top. Side.



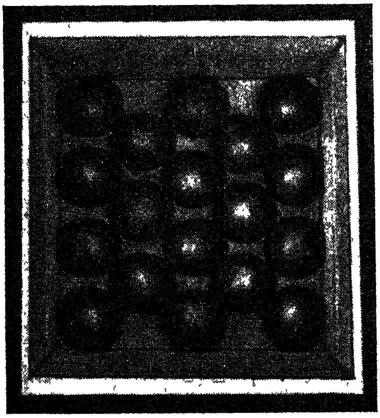
3-2 Pack, 200 Count.

NOTE.—This fruit is wrapped with the Australian Export Kangaroo Wrapping Paper.

PLATE 183.

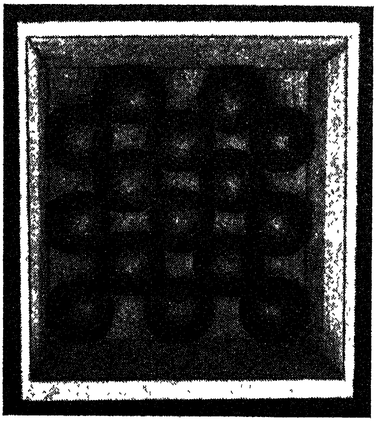
CITRUS EXPORT CASE—*continued.*

3-2 Pack, 4 x 3 Layer Count.
5 Layers = 176.



Total, 176.

3-2 Pack, 3 x 3 Layer Count.
5 Layers = 150.



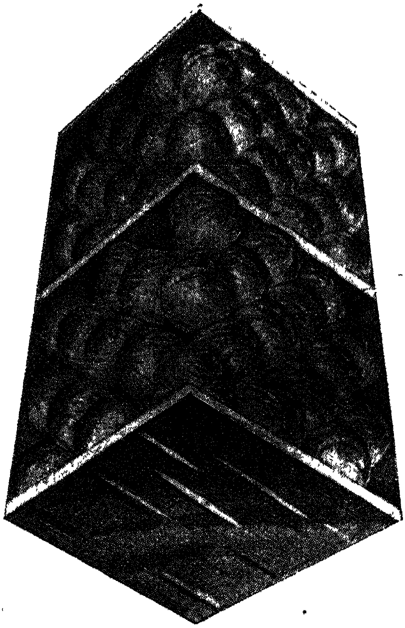
Total, 150.

NOTE.—These first layers only represent a single compartment of the case. Each complete case contains two compartments which must be packed uniformly to obtain the correct count.

Top. Side.

3-2 Pack. Total, 176.

Side. Top.

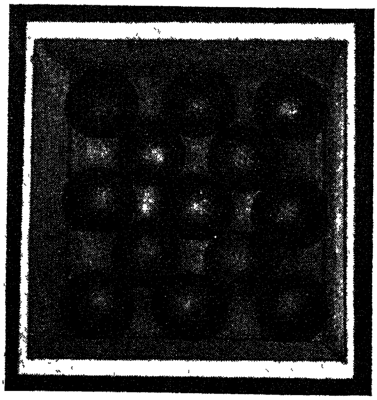


3-2 Pack. Total, 150.

PLATE 184.

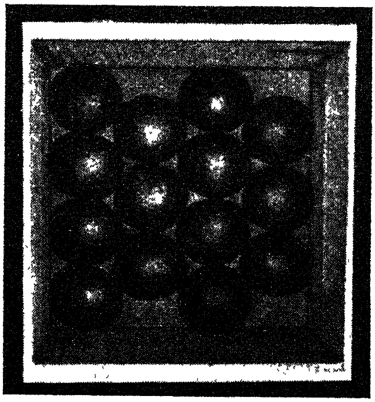
CITRUS EXPORT CASE—*continued.*

First Layer.
3-2 Pack, 3 x 2 Layer Count.
5 Layers = 126.



Total, 126.

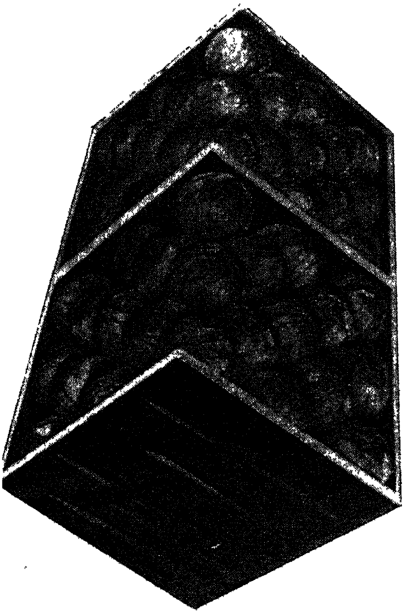
First Layer.
2-2 Pack, 4 x 3 Layer Count.
4 Layers = 112.



Total, 112.

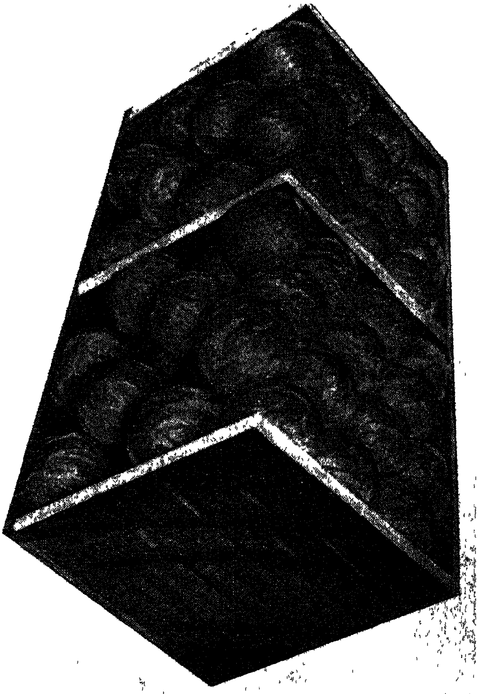
NOTE.—These first layers only represent a single compartment of the case. Each complete case contains two compartments which must be packed uniformly to obtain the correct count.

Finished Case.
Side. Top.



3-2 Pack. Total, 126.

Finished Case.
Side. Top.



2-2 Pack. Total, 112.

PLATE 185.

The Cowpea.

By N. A. R. POLLOCK, H.D.A., Senior Instructor in Agriculture.

THE genus Vigna of the natural order Leguminosæ, to which the species cultivated and known as cowpeas—though they are really beans—belong, comprises upwards of thirty examples which are widely distributed over the warmer regions of the globe.[1] Bailey[2] records four as Australian species, three of which have a wide range in other parts, while one is endemic.

The cultivated varieties of the cowpea are held to be derived from *Vigna sinensis,* a native of Central Africa, where, according to Piper,[3] wild plants little differing from those cultivated are still to be found.

The large number and diversity of cultivated varieties throughout Africa and the warmer parts of Asia and Europe suggest that the crop was cultivated for many centuries.

It is probable that the cowpea was included in the varieties of beans mentioned under the name Phaseolus by old Roman writers, since in Italy the name Fagiolo, the local equivalent of Phaseolus is applied equally to the Kidney bean and the Blackeyed cowpea.[4]

PLATE 186.—A COWPEA CROP ON A NORTH QUEENSLAND FARM.

In countries where the Spanish language is used, the cowpea is referred to as Frijole or Figole, which may also be considered a derivative of Phaseolus.

There are three main varieties of the Cowpea, viz.:—

Vigna sinensis var. *sesquipedalis.*

The Snake, Yardlong or Long Bean, also Asparagus Bean. This subspecies comprises a number of varieties, noted for their long, soft,

and puffy pods, which carry an elongated kidney-shaped seed. They are usually grown on sticks or poles, also without support, and the young pods used when green and brittle in the manner of French beans.

In tropical parts they are much favoured in the summer for culinary purposes. The pods of many of the cowpeas proper, however, are not only more palatable but capable of more economic production.

Vigna sinsensis var. *Cylindrica.*

The Catiang or Indian cowpea, as it is frequently called. This subspecies forms a group of varieties of semi-erect, half bushy plants with pods 4 or 5 inches long, carrying small, hard seeds usually oblong or cylindrical and slightly kidney-shaped. They are generally late in maturing, and on this account not generally popular. The Poona (see under varieties), however, is an exception.

Vigna sinensis.

The common cowpea, of which there are a great many varieties, and to which the balance of the subject matter of this article refers.

Climate.

The cowpea is essentially a summer crop, as it is easily killed by frost. Being a native of warm climates, it can be expected to make the best success in the more tropical parts of the State; but if sown as soon as danger from frost is over, good crops should be obtained in the cooler parts or where a crop of maize can be produced.

It will stand a moderate amount of dry weather, under which condition yield of forage and seed will be much reduced.

Under a heavy rainfall, while the volume of growth will be satisfactory, the yield of seed will be small. The bottom leaves also will be liable to mildew, owing to a poor circulation of air through the mass. Heavy or continuous rain when the pods are ripening is also apt to cause mildew in the seeds.

The best success can be anticipated when growth is made in the hottest months under a good rainfall and fine weather is experienced at harvest or when the pods mature.

Soil.

The cowpea will succeed on almost all types of soil that are sufficiently drained or do not become water-logged. Good crops can be anticipated when growth is made on sandy soils and intermediate types to heavy clays, provided a reasonable amount of plant food is present, the season is favourable, and satisfactory cultivation practised.

The necessity for lime in the soil, so general with most legumes, is less insistent in the case of the cowpea than with others.

On rich soils, a heavy growth of vine may be expected when the yield of seed will be comparatively low. Soils of medium fertility may be expected to yield the largest crops of seed.

Generally speaking, what is regarded as good maize land can be expected to produce the best crops of cowpea both in yield of vine and seed.

Cultivation and Sowing.

The soil should be well ploughed to a depth of at least 6 inches, cross-ploughed if necessary, and brought to a good tilth.

Sowings are usual of single seeds, 3 or 4 inches apart in drills spaced 3 feet apart.

Sown in this manner, 6 to 10 lb. of seed, according to its size, which varies with varieties, will be sufficient for an acre.

An ordinary corn-planter with a suitable plate is satisfactory for sowing, as is also a grain drill when sufficient of the cups are closed to allow of the required spacing.

In broadcast sowing, 20 to 30 lb. is sufficient on clean ground, but frequently larger quantities are used.

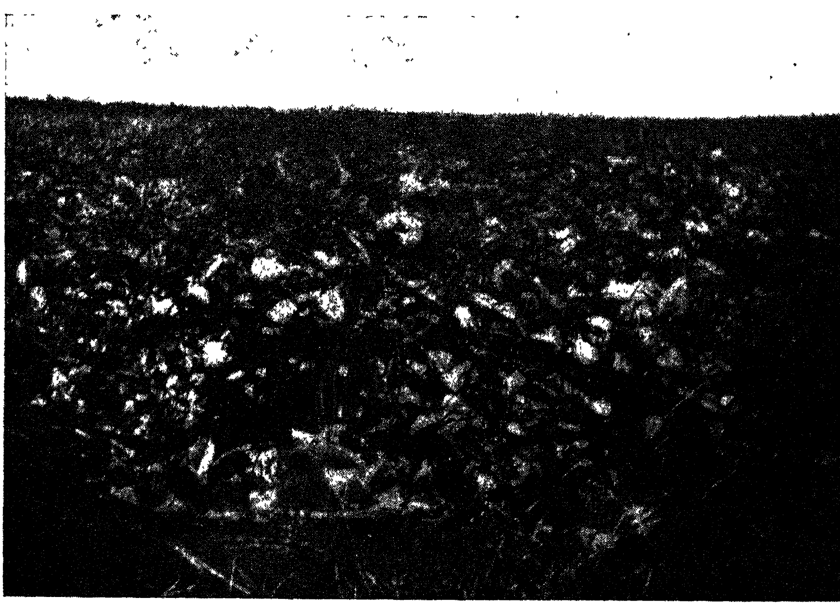


PLATE 187.—A CLOSER VIEW OF A COWPEA CROP.

When sown in this manner, it is advised to have the land somewhat rough and to fine it down with the harrows when covering the seed.

Cowpea seed germinates very quickly, the young plants frequently showing on the third day after sowing.

After cultivation consists in keeping weed growth down and the soil loose between the rows of plants while growth permits, usually over a period of four to five weeks if the season is favourable.

The ordinary cultivators, such as are used with maize, are satisfactory.

Harvesting—Hay.

The best time to cut the crop for hay is when flowering has progressed a little time and a fair quantity of pods have formed. Sometimes, in order to secure seed as well, the crop is left until most of the

pods have matured; the seed is then threshed out or secured from the sieves when cut into chaff. In the latter case the vines are more fibrous, and less leafage can be expected.

In making the hay, the growth should be placed in small, loose cocks as soon as possible after signs of wilting have appeared, so that the circulating air will assist in the transpiration of moisture from the vines through their leaves. After a day usually in the small cocks, two or more can be used to form a larger one until curing is complete. As the leaves afford the greatest nutriment, their retention should be the main objective.

Seed.

When ripe, the pods will assume a straw colour. At this stage rainy or extra humid conditions will cause the seed to mould or to sprout within the pod. The value of fine weather at this stage is therefore apparent.

Frequently, as the pods ripen progressively, especially with late-maturing kinds, it is found profitable to hand-pick the first setting and to secure the remainder by harvesting the plant. Early-maturing kinds usually ripen the majority of the pods within a short space of time, which allows the plants to be harvested and the seed secured by threshing, or from the sieves by cutting into chaff. When securing the seed in this manner it is of advantage to have the vines thoroughly dry and brittle.

When the pods are hand-picked they should be thorough dried, when they are easily broken and the seed secured. The proportion of seed is usually 70 per cent. of the whole pods.

Yields.

The yields of forage or seed of any variety will depend on the fertility of the soil and the season experienced.

Late-maturing varieties, owing to a longer growing period, can be expected to give much heavier yields than those of earlier habit.

From 3 to 4 tons up to 10 to 15 tons of greenstuff and from 3 to 4 up to 20 to 25 bushels of seed may be anticipated under reasonable conditions of soil and season.

Departmental trials in North Queensland over a series of years gave the following results:—

Variety.	Average Yield per Acre.	Number of Trials.	Highest Yield.
	Tons Cwt. Qr.		Tons Cwt. Qr.
Groit	12 0 0	15	22 10 0
Brabham	12 10 0	6	18 19 1
Victor	11 3 0	4	19 5 2
Black	6 5 0	2	6 6 0
Clay	6 0 0	1	

The highest yield of these were recorded as follows:—

Groit Variety.—Carbeen, sown 28th November, estimated 10th February; yield, 16 tons 11 cwt. in 74 days; after further growth estimated 17th April, yield, 22 tons 10 cwt. in 140 days.

Victor Variety.—Tolga, sown 23rd January, estimated 1st May; yield, 19 tons 5 cwt. 2 qr. in 97 days.

Brabham Variety.—Tolga, sown 23rd January, estimated 1st May; yield, 18 tons 19 cwt. 1 qr. in 97 days.

Uses.

Green Manure.—The use of the cowpea as a green manure is becoming increasingly popular, largely from the fact that it provides a big volume of growth in a comparatively short time. In common with most other legumes it adds, in addition to the organic matter, an appreciable quantity of nitrogen to the soil; this is demonstrated by the multitude of nodules formed on the roots by the nitrogen-fixing bacteria.

The greatest volume of growth is naturally afforded by the late-maturing varieties, suggesting these should be sown early in the season.

Quick-maturing sorts are valuable to follow a crop harvested in early summer.

Rotation.—The value of a legume in a sequence or rotation of crops is generally appreciated, not only when it is ploughed under to augment the supply of organic matter in the soil, but from the more vigorous growth of a succeeding crop caused by the added nitrogen from the decay of the roots after the top growth has been removed. Crops such as maize, potatoes, &c., following a cowpea crop, whether cut and removed or ploughed under, invariably experience benefit.

Culinary Use.—The green pods of many of the varieties when young and brittle are esteemed as a table vegetable. Use in this manner is particularly suggested in the summer of tropical parts when other beans, similarly used, cannot be grown.

The seed of many kinds, particularly those white or mottled white in colour, are also esteemed when mature and dry as a haricot bean.

Fodder.—Being a legume and consequently rich in protein, the fodder value of the cowpea at all stages of growth, whether fed green or cured as hay, is exceedingly good.

Combined with its high fodder value is extreme palatability, all stock eating it readily.

Henry and Morrison[5] present the following analyses:—

——	Total Dry Matter in 100 lb.	Digestible Nutrients in 100 lb.				Nutritive Ratio.
		Crude Protein.	Carbo-hydrates.	Fat.	Total.	1:
Seed	88·4	19·4	54·5	1·1	76·4	2·9
Hay before Bloom	92·2	17·8	27·0	1·0	47·0	1·6
Hay in Bloom to Early Pod	89·4	12·6	34·6	1·3	50·1	3·0
Hay Ripe Vines	90·0	6·9	42·1	1·0	51·2	6·4
Hay—All Analyses	90·3	13·1	33·7	1·0	49·0	2·7
Green Vines	16·3	2 3	8·0	0·3	11·0	3·8

The seed, it will be observed, according to the analysis, provides a valuable protein concentrate for feeding to all kinds of stock, including

poultry, though the latter do not often take readily to the whole seed. As the seeds of all varieties are relatively small, they should be crushed or ground to a meal before being fed to stock, and in this state added to the mash for poultry.

Grazing Off.—As a crop for grazing off at all stages of growth, the cowpea offers many advantages. Dairy cows and growing and fattening stock can be grazed for periods each day until growth has ceased, when that not consumed can be ploughed under with ultimate profit. Pigs can also be profitably raised when depastured thereon.

Hay.—When cured as hay a valuable roughage is provided, which can be fed whole or chaffed with other feeds to secure a desired nutritive ratio.

Silage.—The cowpea can also be successfully ensiled when combined with other crops such as maize or sorghum. Added to either of the latter an advantage is gained by the consequent increase of protein.

PLATE 188.—AS A COVER CROP, THE COWPEA IS AN IMPORTANT FACTOR IN FARM ECONOMY.

Cover Crop.—The cowpea has found favour as a cover crop with banana-growers and orchardists to keep down weed growth and to add fertility to the soil. Varieties of upright growth or those of short-running habit, such as the "large clay coloured," are favoured.

As a crop to precede the sowing of lucerne, the cowpea can be recommended, as not only is the land kept free of weed growth and a clean seed-bed provided, but it is inoculated with a nitrogen-fixing bacteria which appears to favour lucerne.

Mixed Crops.

The cowpea can be grown with advantage when the seed is sown mixed with that of other crops, either for grazing off, for silage, or for hay.

With Maize.—Where growth of maize is not too rapid as in the cooler parts of the State, the seed of early sorts can be sown immediately, after the last cultivation of the maize, in the centre between each row. In the warmer parts it is advised to sow both seeds at the same time in the same row, using later-maturing varieties of cowpeas.

The resultant crop can be cut for silage or grazed, or the maize grain can be harvested and the stock then turned in. The mixed crop is considered valuable for raising and fattening pigs.

With Sudan Grass, &c.—Sown combined with Sudan grass, various millets or sorghum broadcast, the addition of the cowpea will improve the fodder value, either when fed off or cured as hay. Both seeds should be sown at the same time. It is advisable, when sowing cowpeas in a mixture, to use those of less erect and more running habit of growth.

Varieties.

Varieties of the cowpea differ in their manner of growth as well as in the period in which they ripen the first pods. Some are early maturing, others late; some are inclined to erect or bushy growth with short runners, while others are procumbent with long runners. Intermediate forms between the two, of course, occur. Some varieties are valuable for their heavy yield of forage, others for the amount of seed they yield.

New Era.—Plants tall, half-bushy, and of vigorous growth. Yields seed freely. Matures medium early, the first pods ripening in about 70 days. Seeds rather small, buff coloured, and speckled with blue.

Whippoorwill.—Plants tall, sub-erect, and half-bushy, giving an abundant growth—a good general purpose kind—matures the first pod in about 80 days. Seed buff coloured, marbled with brown. Pods tend to cluster, which facilitates hand-picking.

Groit.—Regarded as a cross between New Era and Whippoorwill[4] and considered superior to both. It is much favoured in North Queensland. The plants are sub-erect, half-bushy, and of prolific growth. The first pods ripen in about 75 days. Seeds somewhat small and angular, buff in colour, marbled with brown, and thickly sprinkled with bluish spots.

Brabham.—Regarded as a cross between Iron and Whippoorwill varieties.[4] It has done well in the North. The plants are fairly tall, half-bushey, and very prolific. The first pods ripen in about 85 days. Seeds buff in colour, marbled with brown. This variety is regarded as resistant to nematode attack.

Iron.—Plants tall, half-bushy, of moderate growth, and not a free seeder. It is extremely hardy and late in maturing, the first pods ripening after about 90 days. Seed pale-yellowish to reddish-buff. This variety is regarded as resistant to nematode attack.

Victor.—An artificial cross between the Brabham and Groit varieties, originated by the United States Department of Agriculture.[4] Plants tall, half-bushy, and very prolific. The first pods mature in from 80 to 85 days. Seed small brownish-buff and covered with small blue specks. Said to resist nematode attack. It has done well in the North.

Early Clay.—Plants sub-erect and bushy—fairly prolific. An early variety, the first pods maturing under 60 days. Seeds light-buff with a suggestion of pink. The variety, being one of the earliest, is most suitable for the colder districts of the south.

Early Black.—Plants rather procumbent and viney, but yield abundantly. The first pods mature in about 60 days. Seeds black. The variety is suitable for growth with maize or other crops for conservation as fodder or for grazing off. There are a number of varieties with a black seed which vary somewhat in habit of growth and the period of maturity.

Blackeye—Mottled White—Cream and White.—These varieties are regarded as inferior for fodder purposes, and are usually grown for the seed, which is esteemed for table use.

Fertilizers.

Where the soil gives an acid reaction, a top-dressing of lime at the rate of 10 cwt. per acre, or carbonate of lime (earthy lime) at the rate of 20 cwt. per acre, should be applied broadcast to the soil prior to sowing the seed. Though lime is not called for so insistently as in the case of lucerne, its application will be attended with profit on many soils, more especially those in districts of heavy rainfall. Poor soils, such as those of very sandy nature on which the production of bright tobacco is advised and soils somewhat exhausted by continuous cropping, will be benefited by the application of fertilizer. On the more fertile the inclusion of nitrogenous fertilizers is not imperative, as on these soils little benefit is received therefrom, but on those of poorer quality it will be most beneficial. The following mixtures are suggested for each 100 lb.:—

For poor soils—Sulphate of ammonia, 10 lb.; superphosphate, 75 lb.; sulphate of potash, 15 lb.

For better soils in which the humus content is fair—Superphosphate, 85 lb.; sulphate of potash, 15 lb.

Applications may be made at from 100 lb. to 300 lb. per acre, preferably in the drill at the time the seed is sown.

Diseases.

So far in Queensland little trouble has been experienced from disease in cowpea crops beyond slight leaf-spots and the moulds formed on leaves and seed under heavy or prolonged falls of rain.

In other countries trouble has been experienced from wilt caused by a fungus which invades the roots, and, by impeding the flow of sap, causes a wilting and subsequent drying off of the top growth.

Nematodes.

Several varieties are subject to attack from eelworms or nematodes, which form gall-like swellings on the roots and interfere with the growth of the plant. These swellings differ from those formed by the nitrogen-fixing bacteria, which are small, about a quarter of an inch in diameter, and easily detached. Those formed by nematodes are frequently large and massed together, and cannot be detached without breaking the roots. Where nematodes occur—most frequently on sandy soils—the use of resistant varieties is called for.

Insect Pests.

At times the French Bean Fly—*Agromyza phaseoli*—attacks the cowpea in early growth, but damage therefrom, has, so far, not been serious.

The chief insect enemy is a bean weevil which lays its eggs in the pod of the cowpea in the field and also in the stored seed.

While prevention is not possible in the field, the attack of the insect after harvest may be frustrated by treating the seeding in the following manner:—

Exposure to a heat of 120 deg. to 130 deg. Fahr. for an hour or so will kill all insects as well as their eggs. In the warmer parts this heat can frequently be obtained from the sun if the seed is thinly spread on tarpaulins or sheets of iron. Artificial heating by means of hot flues can also be effected.

Fumigation with carbon bisulphide for twenty-four hours.—For treatment the seed should be placed in an air-tight container. In using the carbon bisulphide, 1 lb. is suggested for each 100 bushels of seed, and should be placed in saucers or shallow pans on top of the grain. As it volatilizes, the gas being heavier than air will sink through the grain. After twenty-four hours' contact the grain should be well aired to become free of the gas, which, if left longer, would interfere with germination, and then replaced in air-tight containers. Carbon bisulphide being highly inflammable, care in its use is imperative, no fire or flame being allowed nearby. At temperatures in excess of 60 deg. Fahr., it is most effective.

All stored seed should be thoroughly dry.

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[1] Encyclopedia of Horticulture. Nicholson.

[2] The Queensland Flora. F. Manson Bailey.

[3] Piper, C. V. The wild prototype of the Cowpea. Circ. 124. United States Department of Agriculture.

[4] Morse, W. J. Farmers' Bulletin 1148. United States Department of Agriculture.

[5] Feeds and Feeding. Henry and Morrison.

Dairy Produce Act Provisions Explained.

STABILISING THE INDUSTRY.

THE Dairy Produce Act, which was passed by the Commonwealth Parliament towards the close of last year, provides for the regulation of the transfer of butter and cheese from one State to another, and is on similar lines to the Dried Fruits Act, which was passed by the Commonwealth Parliament in 1928. Its main object is to ensure to all producers of butter and cheese a fair share—and not more than a fair share—of the advantages and disadvantages of selling within Australia and overseas, says an official statement issued at Canberra to-day.

Five years ago Australia exported 45,000 tons of butter overseas. During the year ended 30th June, 1934, this total had more than doubled and reached the high figure of nearly 109,000 tons, of which no less than 102,000 tons were sent to the United Kingdom. The value to Australia of this export trade last year was about £9,000,000.

Great Britain is the principal purchaser of our dairy products. Indeed, apart from a valuable market for some 6,000 tons in the East, the United Kingdom represents practically the only outlet for our exportable surplus, and year by year we have been sending greatly increased quantities to that market.

At the same time increasing quantities of New Zealand and Danish butters were being placed on the British market, and in these circumstances a fall in prices in the United Kingdom was inevitable, in order to bring about the necessary increase in consumption to absorb the greatly increased imports.

The Paterson Scheme.

Until recently a voluntary scheme was in operation known as the Paterson Plan, which was designed to assist in ensuring a more remunerative price for butter sold in Australia. Under this plan a levy was paid on all butter manufactured, and from the fund thus created a bounty was paid on all butter exported.

The existence of the bounty on exported butter brought about an automatic increase in the local price, and the dairying industry profited considerably from this enhanced price.

In view of its voluntary nature, it has been found difficult by the dairying industry to sustain the Paterson Plan. For some time there was an increasing tendency on the part of factories to break away from the scheme, and the industry claimed that another section of the butter-producing industry—the people who make butter on farms—were not making any contribution towards the stabilisation of the industry. These persons, together with the factories which had broken away from the plan, were reaping the full advantages and benefits of the improved conditions made possible by means of the Paterson Plan. In consequence of these circumstances and because of the large amount of butter being exported, the scheme rapidly lost its effectiveness.

The question of stabilising the industry by means of State and Federal legislation on the lines of the existing Dried Fruits legislation was first discussed at a Conference of Ministers for Agriculture held in

May, 1933, and in the following month the matter was further discussed at a conference of Premiers, at which the Commonwealth Government agreed that it would fully consider any proposal for the introduction of Commonwealth enabling legislation in the event of the adoption by the States of marketing measures in respect of butter.

The States of New South Wales, Victoria, Queensland, and Tasmania, which, in the aggregate, produce approximately 90 per cent. and 80 per cent. of the total output of butter and cheese respectively in Australia, have enacted legislation under which a Board has been established in each of those States to regulate the intra-State marketing of butter and cheese.

The Home Market.

One of the principal provisions in each of the State measures is that which empowers the respective State Ministers in conjunction with the proposed Boards to determine the quantities of butter and cheese which may be sold on the home market. The States, however, are not empowered to regulate the interstate transfer of goods without which it would not be possible to ensure that the balance of butter and cheese over and above that determined for home consumption shall be exported overseas. To meet this position, it was essential that there should be Commonwealth legislation which would prohibit interstate trade in butter and cheese except under license, which license will only be granted subject to the condition that the licensee shall comply with export quotas fixed by the Minister for Cmmerce. These export quotas are determined on the recommendation of prescribed authorities appointed by the Commonwealth. In those States where Boards are established under State legislation, the Boards act as Prescribed Authorities. The export quota determined in respect of butter manufactured during the months of May and June, 1934, was 55 per cent. and 50 per cent. for the month of July. The first export quota fixed for cheese was 25 per cent. for the month of July.

The system of export quotas prevents price-cutting on the Australian market, and assures that the producer will take his fair share of the less remunerative export markets—that is to say, the burden of export is equally shared.

Protection Against Gluts.

The system of control as is now applied to the dairying industry in relation to interstate trade does not necessarily involve any increase in the price to the Australian consumer over and above the additional cost previously brought about by the operation of the Paterson Plan. The Government believes it is necessary to the interests of the industry that those engaged in it should be protected by legislation against the possibility of glutted home markets and consequent adverse realisations.

The Federal Act was brought into operation by proclamation issued on the 2nd May, 1934, and it is provided in the Act that a poll of dairy producers throughout the Commonwealth shall be taken within six months after the commencement of the Act, to decide whether or not the legislation shall continue to operate. In this connection the Government considered that notwithstanding the assurances given by representatives of the industry to the effect that a majority of the producers were favourably disposed towards marketing legislation of this nature, it was desirable that the producers should be given the right to decide the matter for themselves.

The persons eligible to vote are those who, during the year ended 31st December, 1933, were producers of milk and either manufactured and sold at least 500 lb. of butter and/or cheese, or supplied to a factory sufficient milk or cream to produce at least 500 lb. of such produce. Where two or more partners produced the necessary quantity of milk or dairy produce from cows owned by them, each partner is eligible to claim enrolment, and in the case of farms worked on the share system the owner of the cows is regarded as the person entitled to claim enrolment. Each voter is entitled to one vote only, notwithstanding the number of farms in which he may have an interest.

The Closing Date.

The closing date for the poll is the 11th October, 1934.

There is in existence another organisation which is not controlled in any way by Commonwealth or State legislation. This organisation is known as the Commonwealth Dairy Produce Equalisation Committee Limited, which is registered under the New South Wales Companies Acts, with headquarters in Sydney.

The principal function of the committee is to secure to manufacturers of dairy produce, as far as reasonably practicable, equal rates of returns from sales made in Australia and overseas. In cases where manufacturers either over-sell or under-sell (on a quantity basis) on the Commonwealth market, an equalisation cash adjustment is made by the committee representing the difference between the Australian and overseas prices.

PLATE 189.—LARGE WHITE GRADE BACONERS AT MR. C. B. PETER BELL'S PIG FARM, MAROON, NEAR BOONAH.

This is a typical scene on Maroon, where approximately 1,000 pigs are raised each year under grazing conditions and fed entirely on maize and meat meal with lucerne and paspalum pasture.

Pampas Grass as Winter Cow Feed.

EXTRACTS FROM AN ARTICLE BY MR. B. C. ASTON, CHIEF CHEMIST, DEPARTMENT OF AGRICULTURE, NEW ZEALAND, IN THE NEW ZEALAND JOURNAL OF AGRICULTURE FOR 21ST MAY, 1934.

The Government Botanist, Mr. C. T. White, who has extracted this article, states that the correct name of the Pampas Grass, according to determinations received from the Royal Botanic Gardens, Kew (England), is Cortaderia Selloana, *though it is most frequently known to gardeners under the older name of* Gynerium argenteum. *Mr. White further states that it is quite common in gardens in many parts of Queensland, and the article by Mr. Aston seems to offer a use for the grass hitherto undreamt of. It is a tall-growing grass familiar to most people on account of its white, feathery plumes. A rather smaller kind with reddish plumes is sometimes seen. This is not a different species or variety as sometimes thought, but represents the male plant, the white being the female. Propagation of the plant is by seeds or divisions. It is not certain that the plant provides fertile seed in Queensland, but the general means of propagation is by division of the plants, a large clump giving a great number of roots suitable for planting out.*

The best time for planting out the grass is probably about September and October, or during the early summer rains, and about 1,000 plants would be required to plant an acre, the plants or roots being placed about 6 feet apart each way.

It might be mentioned that the grass when tested for the presence of a prussic-acid yielding glucoside has always given positive results for the presence of such a glucoside in Queensland-grown specimens, but if reasonable care is exercised in not letting cattle on to the grass on too empty a stomach, or allowing them to gorge themselves on it, little or no trouble should be experienced from it.—ED.

Mr. Aston writes: When dead or old leaves are prevented from accumulating by firing every year after cattle have eaten down the succulent green portions and some of the dead leaves, the subsequent growth is tender and easily grazed by cows.

One farmer, Mr. George Short, of Dargaville, writes that twenty-two years ago he had his first experience of pampas, and since then he has always grown it for shelter and stock food, for in winter all stock are fond of it, breaking down good fences to get at it. He has grown it on drain banks, in paddocks, and on hill land. It grows as well on poor gum land as it does on good swamp land. It would be a great asset to exposed farms near the coast where other shelter cannot thrive owing to salt winds. Mr. Short has not grown it for fodder alone, but knows its value as stock food. He sends photos of hedges he planted at Turiwiri, Northern Wairoa, one of the oldest of which is six years old and 10 feet high and shows signs of being well grazed as far as cattle can reach.

To Mr. Alec McClean, of Waitakaruru, Hauraki Plains, must, however, be given the great credit of being the first to profit adequately from his observations that cattle are inordinately fond of pampas in the autumn by systematically planting and using it as winter feed as described in the previous article. Since then Mr. McClean has extended

his plantations and has continued to use pampas systematically as winter food and has answered all inquiries which have come from both local and overseas farmers. He has willingly received and explained to deputations of agriculturists, chemists, veterinarians, pressmen, and other farmers his method. He has also supplied, at a nominal price, roots to those desiring to make experiments. Succcss has not come to Mr. McClean without perseverance in the face of many obstacles. Without knowing any of the previous opinions or work of others with pampas, and without any official guidance and advice, and, as he puts it, in the face of all sorts of discouragement and carping criticism which required quite a lot of determination to disregard, he has demonstrated beyond doubt that a new fodder plant is available which is destined, it is thought, to have very far-reaching effects in cheapening production in every branch of cattle farming.

The result of pampas-feeding on Mr. McClean's own cattle has been the subject of investigation by competent visitors who have expressed their appreciation of the condition of the stock on the farm. Although milking what is called "a very ordinary herd," mostly Jerseys, he is topping his district against all suppliers for amount of butter-fat per cow per month, which is shown by the factory returns, although many of his neighbours have wellbred stock with high butter-fat records. Mr. McClean's results are all the more remarkable as no top-dressing is done on his farm. The soil is not excessively moist in Ngatea, and in summer months it becomes decidedly dry. The soil is peaty, the subsoil being a rich clay. For further information of the Hauraki Plains soil see this "Journal," June, 1914.

Mr. McClean's method of laying out his plantations is simple and efficient. An area 1 or 2 chains wide and several chains in length is planted in the spring with pampas roots 6 feet apart, which provides approximately 1,000 plants to the acre. These are not fed-off until the second year, by which time the estimated yield of green material per plant is, roughly, 1 cwt., or 50 tons to the acre.

During the past winter Mr. McClean has fed 130 head of grown stock and 70 head of young stock on 2 acres of pampas with a run-off of 48 acres. Feeding-off was commenced on the 14th June, 1933, and finished on the 20th August, a period, approximately, of ten weeks. The method by which the cow with its soft mouth is able to demolish and graze these tall sedge-like growths varies with the individual. Some animals favour pulling the canes from the base while others take hold of the leaves almost at the tips. Either method appears to be equally easy to stock and causes them no inconvenience whatever.

Perhaps the feeding of pampas may be extended to cover supplementary requirements of early spring when stock tend to scour—for which it is an antidote—and late summer when the pasture tends to be overloaded with clovers and therefore requires balancing with a diet less rich in protein and still palatable, which pampas certainly is. The feeding of excess of protein is wasteful and, some authorities hold, injurious (see this "Journal," February, 1929, p. 97).

Mr. C. R. Taylor in going through the pumice country has taken the opportunity of inspecting shelter-belts of pampas, and finds them regularly grazed every winter by stock leaving good pasture to do so. He concludes that pampas has an economic value hitherto undreamed of and a definite place in every farm in the future.

By H. W. BALL, Assistant Experimentalist.

LAST July rains throughout the chief farming areas were of considerable benefit to all primary producers. Early wheat crops are now well established, and in many instances could not look better. The July falls, together with the storm rains received on 10th August, assured a successful winter season and came at a most opportune time to permit the planting of potatoes and onions below the Range, and also greatly assisted the working of land for all spring crops. The Central-west and South-western districts also benefited considerably, so that pastoralists in those areas are now assured of a good spring.

Maize.

Large areas are being prepared for the sowing of early maize as conditions are generally favourable for seeding operations. From a grain production point of view the early maize crop is always a risky one, but if seasonal conditions warrant it can always be profitably utilised as fodder or silage, and is therefore never a complete loss. This Department's stocks of Funk's 90 Day, Golden Beauty, and Star Leaming pure seed maize are now exhausted, but supplies of Reid's Yellow Dent and Improved Yellow Dent are still on hand.

Wheat.

Prospects for the 1934-35 crop are now greatly improved. Late sown areas have responded well to the favourable conditions, so that given average rains during September and October an excellent yield is

indicated. Chiefly owing to drought conditions in the United States of America and Canada, wheat prices have developed an upward trend and are now higher than at any time since August, 1930. There is every indication that the improvement will hold, as under-average crops are forecasted in many exporting and consuming countries, thus diminishing further the accumulated world surplus and paving the way for an improved basis of future trading. The Queensland Wheat Board does not consider that a Commonwealth Pool would be in the best interests of growers in this State, but that greater material advantage would be

Plate 190.—A Crop of "Currawa" Wheat, Darling Downs.

"Mountain or river or shining star,
There's never a sight can beat—
Away to the skyline stretching far—
A sea of the ripening wheat."

obtained by the establishment of State Pools to deal with local consumption and co-operating as far as possible in the stabilisation of prices from year to year, leaving the matter of export to be dealt with by a Commonwealth body. Cheques covering the payment of the first advance of the wheat bounty granted by the Federal Government are now being posted to growers, payment being made on the acreage basis.

Peanuts.

Queensland's second largest peanut crop has recently been harvested, over 3,000 tons being delivered to the silos. This quantity should easily meet Australian requirements. Growers are naturally disappointed at the statement recently issued by the Tariff Board, that no increase in the general tariff rates on peanuts could be granted, as they consider the present duty inadequate to protect the industry from the importations of nuts in shell, and of the lower-grade nuts used for oil extraction. There is no doubt that Queensland is now producing a high-grade nut suitable for both household and manufacturing purposes. Peanut cultivation is now centred in the South Burnett, but is increasing in the Central and Northern districts.

PLATE 191.—ANOTHER CROP OF "CURRAWA" WHEAT AT KINKORA.

". . . with a feelin' like content,
An' I feel like thankin' Heaven for a day in labour spent."

Tobacco.

"*The Tobacco Industry Protection Act of* 1933" came into operation as from 12th July last. This Act provides for the registration of tobacco growers, sellers of tobacco seed and seedlings, and for the destruction of old plants subsequent to harvest. Tobacco districts and pure seed areas are also defined. The chief object is to secure greater

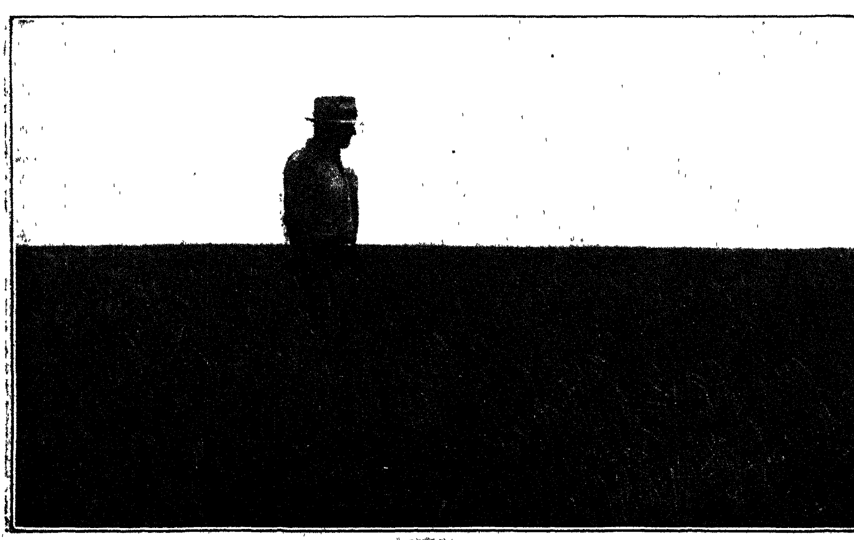

PLATE 192.—A FIELD OF "FLORENCE" WHEAT, DARLING DOWNS.

"And the breeze sweeps o'er the rippling rows,
Where the quail and skylark nest."

control over the pests and diseases that are the chief factors in retarding the progress of this promising new industry. Registration forms are being prepared and will be posted to all growers as soon as possible. Northern sales, held late in July, disposed of 54 tons of leaf, some of which was 1933 stock. The average price received was 2s. 6d. per lb., several parcels bringing 4s. At Dalgety's sale, held in Brisbane on 16th August, 86 tons were offered, representing the principal tobacco-growing areas in the North, namely, Dimbulah, Mareeba, Woodstock, Charters Towers, Bowen, Koumala, Miriam Vale, Sarina, and also the south-western districts of Texas, Yelarbon, and Inglewood. As the offerings comprised a larger proportion of medium and inferior grades than in previous sales the average prices realised were lower. The top price, 4s. per lb., was paid for attractive lines from Dimbulah, Bowen, and Charters Towers.

Dairying.

All dairymen are advised to get on the roll and vote "Yes" in the forthcoming ballot under the Commonwealth Dairy Produce Act for the Dairy Produce Equalisation Plan. Owing to increasing production and the uncertain overseas markets, it is generally considered that without such a plan in operation butter prices in Australia will reach a lower level than ever before, probably falling to London parity, which would be disastrous for the producers.

WARTS—A COMMON UDDER TROUBLE.

Warts, which are really small tumours, occur frequently on the udder and teats of the cow. They are seen more often in young than in old cattle. There is some evidence to indicate that they may be infectious. When numerous, they make the process of milking difficult, and as a result of the friction, particularly in stripping, they may result in sore teats. Warts are of different shapes, some are rather long and have a distinct neck, others are flattened, whilst others again are cylindrical in shape. Sometimes they will disappear spontaneously, but usually treatment is necessary.

Treatment is preferably carried out when the cow is dry. Actual removal by surgical methods provides the best means of treatment. Where warts are flattened and extensive, the operation should be carried out by a veterinary surgeon, but where they are of such a nature as to be easily snipped off with scissors, this can be done by the farmer himself. After washing the teat to remove all dirt, it should be immersed in a vessel containing weak disinfectant for some minutes, before the operation is carried out. Bleeding is usually slight and may be controlled by the application of "white lotion," made up of ¾ oz. sulphate of zinc, 1 oz. acetate of lead, and 1 pint boiled water. A white deposit will form in the bottle when it is allowed to stand. The bottle should be well shaken before the liquid is used. For safety the bottle should be labelled "Poison."

The application of various medicaments will frequently remove warts without recourse to surgical means. For this purpose castor oil applied several times daily, caustic solutions, and acids have been used with success. When strong caustics or acids are employed a ring of vaseline should be placed round the wart so that the material applied will not spread and scald the surrounding skin. Treatment of warts by the application of the preparations mentioned requires preseverance, since removal in this way is slow.

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 4th September, 1934, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for September, October, November, and December, 1934:—

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 4th September, 1934—''Seasonal Farm Crops,'' Part I. By C. J. McKeon, Instructor in Agriculture.

Thursday, 6th September, 1934—''Seasonal Farm Crops,'' Part II. By C. J. McKeon, Instructor in Agriculture.

Tuesday, 11th September, 1934—''Seasonal Farm Crops,'' Part III. By C. J. McKeon, Instructor in Agriculture.

Thursday, 13th September, 1934—''The Tobacco Industry Protection Act of 1933.'' By H. S. Hunter.

Tuesday, 18th September, 1934—''Some Requirements of Plant Growth.'' By E. H. Gurney, Agricultural Chemist.

Thursday, 20th September, 1934—''Fertilizers and Manures.'' By E. H. Gurney, Agricultural Chemist.

Tuesday, 25th September, 1934—''Nutritive Value of Pasture.'' By E. H. Gurney, Agricultural Chemist.

Thursday, 27th September, 1934—''Mineral Ingredients in Stock Foods.'' By E. H. Gurney, Agricultural Chemist.

Tuesday, 2nd October, 1934—''Mammitis, a Disease of Dairy Cows.'' By K. S. McIntosh, H.D.A., B.V.Sc., Government Veterinary Surgeon.

Thursday, 4th October, 1934—''Worms in Pigs.'' By F. H. S. Roberts, M.V.Sc., Entomologist.

Tuesday, 9th October, 1934—''Feeding the Growing Pig.'' By L. A. Downey, Instructor in Pig Raising.

Thursday, 11th October, 1934—''Housing and Management of Pigs.'' By L. A. Downey, Instructor in Pig Raising.

Tuesday, 16th October, 1934—''Insecticides,'' Part I. By R. Veitch, B.Sc., F.R.E.S., Chief Entomologist.

Thursday, 18th October, 1934—''Insecticides,'' Part II. By R. Veitch, B.Sc., F.R.E.S., Chief Entomologist.

Tuesday, 23rd October, 1934—''Insecticides,'' Part III. By R. Veitch, B.Sc., F.R.E.S., Chief Entomologist.

Thursday, 25th October, 1934—''Insect Pests of Ornamental Trees.'' By A. Brimblecombe, Assistant to Entomologist.

Tuesday, 30th October, 1934—''Worms in Poultry.'' By F. H. S. Roberts, M.V.Sc., Entomologist.

Thursday, 1st November, 1934—''Black Spot of Citrus.'' By L. F. Mandelson, B.Sc. Agr., Assistant Plant Pathologist.

Tuesday, 6th November, 1934—''Marketing Pigs,'' Part I. By E. J. Shelton, H.D.A., Senior Instructor in Pig Raising.

Thursday, 8th November, 1934—''Marketing Pigs,'' Part II. By E. J. Shelton, H.D.A., Senior Instructor in Pig Raising.

Tuesday, 13th November, 1934—"Red Scale of Citrus." By W. A. T. Summerville, M.Sc., Assistant Entomologist.

Thursday, 15th November, 1934—"Care and Management of Growing Poultry Stock." By P. Rumball, Poultry Expert.

Tuesday, 20th November, 1934—"Dairy Problems No. 1." By F. J. Watson, Dairy Instructor.

Thursday, 22nd November, 1934—"Dairy Cattle Breeding." By C. F. McGrath, Supervisor of Dairying.

Tuesday, 27th November, 1934—"Butter Defects." By G. H. E. Heers, Senior Grading Inspector.

Thursday, 29th November, 1934—"The Care of the Foot of Domestic Animals." By J. A. Rudd, L.V.Sc., Director, Animal Health Station, Yeerongpilly.

Tuesday, 4th December, 1934—"Mineral Deficiency—a Common Disease of Farm Animals." By K. S. McIntosh, H.D.A., B.V.Sc., Government Veterinary Surgeon.

Thursday, 6th December, 1934—"Strangles in Horses." By J. A. Rudd, L.V.Sc., Director, Animal Health Station, Yeerongpilly.

Tuesday, 11th December, 1934—"Pineapple Fruit Rots." By H. K. Lewcock, M.Sc., Assistant Plant Pathologist.

Thursday, 13th December, 1934—"Dairy Problems No. 2." By F. J. Watson, Dairy Instructor.

Tuesday, 18th December, 1934—"Herd Recording." By L. Andersen, Senior Herd Tester.

Thursday, 20th December, 1934—"Dairy Problems No. 3." By F. J. Watson, Dairy Instructor.

PLATE 193.—KINGAROY FROM THE TOP OF THE PEANUT SILO, LOOKING NORTH OF WEST.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled for the month of July, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Kilbirnie Ethel 3rd (365 days)	Macfarlane Brothers, Radford	18,108·4	829·29	Mowbray of Barbalara
Mabel of Sunnyview	J. Phillips, Wondai	13,564·3	526·772	Diamond of Greyleigh
Favourite 6th of Oakvilla	W. Marquardt, Wondai	13,082·38	518·709	Victory of Greyleigh
Nita 8th of the Cedars	W. J. Barnes, Cedar Grove	12,748·16	492·161	Red Knight of Greyleigh
French View Lady May	S. H. Teese, Veresdale	11,642·1	456·889	Chermside of Thornleigh
Westbrook Violet 8th	C. O'Sullivan, Greenmount	11,532·64	452·170	Sheik of Upton
Rhodesview Beauty 4th	W. Gierke and Sons, Helidon	11,459·27	436·240	Birdwood of Blacklands
Ruby 2nd of Glen Allyn	G. Short, Malanda	9,107·25	400·534	Woodrow of Eacham Vale
Princess 7th of Oakvilla	H. F. Marquardt, Wondai	10,469·22	391·325	Victory of Greyleigh
Rose II. of Wilga Vale	A. E. Vohland, Aubigny	9,982·25	390·835	Brilliant of Wilga Vale
Rosemount Jumper 2nd	A. J. Bryce, Maleny	10,075·4	383·756	Victor of Oceanview
Stately 2nd of Bri Bri	W. Middleton, Cambooya	7,880·25	377 624	Lord Brilliant of Bri Bri
Marcheta of Happy Valley	R. R. Radel, Coalstoun Lakes	8,918·3	377·118	Molly's Hero of Glenthorn
Lavender 8th of Quarnlea	Lehfeldt Brothers, Kalapa	10,039·31	373·369	Lord Nelson of Blacklands
Shamrock of Happy Valley	R. R. Radel, Coalstoun Lakes	8,393	358·296	Molly's Hero of Glenthorn
SENIOR, 4 YEARS (OVER 4½ YEARS) STANDARD 330 LB.				
Primrose 5th of Bri Bri	W. Middleton, Cambooya	8,017·5	386·924	Lord Brilliant of Bi Bri
Rosenthal Maggie 8th	A. Sandilands, Wildash	9,172	374·223	Sunrise 3rd of Rosenthal

	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Penrhos Phyllis	A. Sandilands	8,382	344·367	Coral Brae Bonnie's Charmer
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Champion 12th of Oakvilla	H. Marquardt, Wondai	12,066·04	488·286	Victory of Greyleigh
Villa Maria Broady 5th	J. Buckley, Rose Hill	6,948·5	335·798	Villa Maria Sir Charles
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Oakvilla Princess 11th	H. F. Marquardt, Wondai	9,386·24	403·493	Gordon of Swanlea
Amiens' Emblem	B. Carter, Gleneagle	8,960·45	330·54	Empire of Springdale
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Robina of Sunnyview	J. Phillips, Wondai	11,114·92	424·851	Lovely's Commodore of Burradale
Milstream May	W. J. Barnes, Cedar Grove	6,542·21	283·206	Whittier of Thornleigh
Primrose 8th of Bri Bri	W. Middleton, Cambooya	5,969·75	275·677	Majestic of Bri Bri
Jean 10th of Quarnlea	Lehfeldt Brothers, Kalapa	6,574·42	274·418	Nugget's Lad of Hillview
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LBS.			
Navillus Empress II. (272 days)	C. O'Sullivan, Greenmount	8,398·06	350·887	Midget's Sheik of Westbrook
Kingsdale Alice 27th	A. A. King, Mooloolah	7,318·35	316·382	Express of Burradale
Morden Nina 15th	R. Mears, Toogoolawah	6,990·95	306·482	Jupiter of Morden
Sunnyview Gem II.	W. L. Burnett, Brookfield	8,219·44	286·94	Lovely's Commodore of Burradale
Kyabram Daphne	A. H. Black, Kumbia	6,090·3	277·982	Ledger of Greyleigh
Royston Melba 3rd	T. G. O'Maara, Humphrey	7,050·15	272·297	Phœnix of Springdale
Colulu Phyllis	J. Bambling, Gunalda	6,053·3	257·193	Cooee of Bellwood
Sunnyview Nellie 6th	W. L. Burnett, Brookfield	5,819·28	253·418	Lovely's Commodore of Burradale
Navillus Model III.	C. O'Sullivan, Greenmount	6,594 51	252·077	Midget's Sheik of Westbrook
Worangg Frances III.	R. Ray, Yargullen	4,878·9	230·028	Rosenthal's Roseleaf's Dividend
	JERSEY.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Golden Fairy of Burnleigh	Chas. Klaus, Mundubbera	6,845·5	378·29	Noisy Jim of Burnleigh
Glengarry Mabel 2nd	J. and R. Williams, Crawford	6,857·2	361·103	Mike's Viscount of Kelvinside
Silver Wattle of Burnleigh	Chas. Klaus, Mundubbera	6,815·5	356·237	Trinity Baron

Production Recording—*continued*.

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Countess of Fernlea	Kittle Brothers, Gleneagle	6,244·5	336·26	Brookland's Gilded
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Greenstock Poppy	J. B. Keys, Gowrie Little Plains	8,842·11	417·186	Greenstock Commander
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Goulburn of Fernlea	Kittle Brothers, Gleneagle	6,945·3	340·413	Norwood Noble Boy
Glenmah Lady Viola	F. A. Maher, Moggill	5,538·4	289·593	Glenmah Victor's King
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Bellefaire Bonaparte's Bon Bellette	F. J. Cox, Imbil	6,112·35	379·988	Bonaparte of Rozel
G. N. Rozel 5th	Cox Brothers, Maleny	4,591·1	264·849	Retford Royal Atavist
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
White Rose of Hamilton	J. Witton, Raceview	5,988·98	375·075	Retford May's Victor
Eastland's Ginger Princess	T. Bourke, Dallarnil	4,328·9	279·405	Cornelius Prince of Rosedale
Glenmah Victor's Queen (270 days)	F. A. Maher, Indooroopilly	4,941·9	275·331	Retford Victor's Noble
Dassie of Billabong	J. Mollenhauer, Moffatdale	5,393·91	257·935	Premier of Calton
G. M. Foxglove 4th	Cox Brothers, Witta	4,441·7	252·491	Retford Royal Atavist
	GUERNSEY.			
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Laureldale Rosette	W. A. Cooke, Maleny	6,639	320·141	Linwood Favour
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Laureldale Honour	W. A. K. Cooke, Maleny	5,954·85	266·918	Linwood Favour

PLATE 194.—REPRESENTATIVE PIG BREEDERS.

A deputation representative of the Queensland Branch, Australian Stud Pig Breeders' Society, to the Minister for Agriculture and Stock, Brisbane, 10th August, 1934. The deputation discussed with Mr. Bulcock many matters of importance to breeders, and thanked him for his practical efforts to assist the industry. Front row, left to right.—E. J. Shelton, Miss M. Patten (Department of Agriculture and Stock), R. Turpin, Hon. Frank W. Bulcock, Mrs. A. Alford, Miss J. Handley. Back row.—Messrs. Manning (rep. H. B. Kerner), J. Barkle, Mat. Porter, J. Gamble (rep. G. W. Winch), P. V. Campbell (President), J. C. Henderson, G. Handley, A. E. Gray (N.S.W.), R. V. Hamilton, T. J. Collins (N.S.W.).

Answers to Correspondents.

BOTANY.

The Coconut.

M.A.J. (Tewantin)—

We have no pamphlet for distribution dealing with the planting, growth, and cultivation of the Coconut Palm and the processes of making copra. Coconuts should be planted in nursery beds and either put upright in the soil with the pointed end downwards and buried at least two-thirds in the ground, or they may be planted on their side, a portion of the nut being left above the surface of the soil. Germination generally takes place in from four to eight months, and when they are anything from 2 to 4 feet high the young palms can be transferred to their permanent positions.

Various methods of planting are employed on different plantations, but about 25 feet apart all round, allowing 70 to 80 plants to the acre, has been found satisfactory. Keeping down weed growth in plantations is rather difficult, but it is usual to grow a cover crop, generally of some legume. The cover crop is usually of a creeping nature, such as the Black Mauritius Bean or similar plant.

The nuts for copra making are either sun-dried or kiln-dried, but as most of the nuts are grown in countries with a heavy rainfall and very humid conditions, oven-drying or kiln-drying is generally resorted to.

You are rather far south for the successful cultivation of coconuts for commercial purposes, and owing to the present very low price of copra and the enormous supplies available, it is not considered that the establishment of fresh plantations, even under the most favourable conditions, is warranted at the present time.

Curly Mitchell Grass. "Tar Vine."

R.D.L. (Nelia)—

The specimen of Mitchell Grass represents *Astrebla lappacea*, the Curly Mitchell Grass. This is the commonest species in Queensland, and, generally speaking, we think, can be regarded as the best. It retains a certain amount of food value even when dried. Regarding a lick to supply deficiencies, the Agricultural Chemist has made several analyses of this grass at different times of the year, and he will reply to you direct regarding a lick to supply the deficiency in the pasture, particularly the winter pasture.

The vine sent under the name of Tar Vine is *Boerhaavia diffusa*. This vine is widely spread throughout Queensland and the Northern Territory, and is regarded as being of high fodder value. Your notes on it were appreciated.

Grasses of the Gladstone District.

G.S. (Gladstone)—

There are probably about 100 native grasses in the Gladstone district. These include different sorts of Panic Grasses, Star Grasses, Love Grasses, Spear Grasses, and others.

The usual practice with the Grass and Fodder Clubs of State Schools is for the members to collect small samples and forward them for identification and report. We would advise you to follow this course during the coming season. Of grasses a few seed heads should be sent, and where possible one stalk should be pulled up from the roots and doubled backwards and forward so that it can roll comfortably into a piece of newspaper.

Where more than one specimen is sent, each should be numbered and a duplicate retained, when names corresponding to numbers will be returned. Of weeds, fodder plants, &c., a shoot a few inches long bearing either flowers or seed pods should be sent. It can either be forwarded fresh or can be pressed flat between sheets of ordinary newspaper for a few days or until it is quite dry before sending.

Mossman River Grass.

K.C. (Cairns)—

The specimen is *Cenchrus echinatus*, a burr grass that is a native of Tropical America, but now found as a weed in most tropical and subtropical countries. It is quite common in Northern Queensland and is sometimes known as the Mossman River Grass. Stock will eat it to about the same extent as they will the Bunch Spear Grass, and consequently it has some value, although it is very objectionable on account of the wealth of burrs it sheds, and where it will grow we should think better grasses could be planted.

Frangipanni.

W.E.K. (Chillagoe)—

Although Frangipanni is an extremely common plant in Queensland gardens, we have no record of it causing severe pain and temporary blindness if the sap gets into the eyes, like that of Mistletoe Tree and Poinsettia. In most of these plants with a milky sap, however, the sap has a blistering effect, and we should say that if the Frangipanni sap did get into the eye it would cause pain and blindness perhaps for anything from an hour or two to a couple of days. Although the Frangipanni is widely cultivated in tropical countries we can find no reference in literature, either in India or elsewhere, to the sap having caused blindness in human beings or stock. The only reference we can find to the sap is that in Bengal it is used as a purgative. Personally, if ordinary precautions are observed, we can see no objection to cultivating the tree.

Weir Vine.

L.G.W. (Roma)—

As you suggest the Weir Vine is a native of Queensland. Its botanical name is *Ipomaea Calobra*, the specific name being taken from the common aboriginal one for the plant in parts of the West. The vine is very closely allied to the sweet potato, and several white residents have told us that they have used the underground tubers as a substitute for yams or potatoes and found them moderately good eating. Others have informed us that they have chewed portions of the underground tubers to allay thirst.

The poisonous principle is unknown, but apparently resides in the green parts of the plant and if anything seems most abundant in the green seed pods. The isolation and identification of these rather vague poisonous bodies in plants by ordinary chemical analysis is a very difficult matter.

Emu Grass. Blue Panic.

W.G. (Dalby)—

The specimen represents *Psoralea tenax*, sometimes known as Emu Grass and sometimes as Native Lucerne, although this latter vernacular is applied to a number of leguminous plants in Queensland. It is an extremely valuable fodder plant, and worthy of every encouragement where it is growing. Sometimes stock do not take to it very readily, but once they get a liking for it they eat it freely and the plant is very nutritious.

Regarding Blue Panic, we think you would be well advised to try a plot of this grass in your district. We are rather inclined to regard Blue Panic in your district as suitable more particularly for small paddocks, say 3 to 5 acres, for periodical feeding off.

Ellangowan Poison Bush.

J.K.G. (Clifton)—

The specimen is, as you said, the Ellangowan Poison Bush (*Myoporum desertii*), a shrub widely distributed in Queensland and one long suspected of poisoning stock. Feeding experiments recently carried out confirmed the popular belief. Acute constipation and intense inflammation of the digestive tract are features of Myoporum poisoning. Most of the trouble experienced in Queensland has been from travelling stock.

General Notes.

Staff Changes and Appointments.

Mr. L. Moriarty, Inspector of Dairies, Clifton, has been appointed also an Inspector under the Slaughtering Act.

Mr. D. L. McBryde, of Tully Sugar Mill, Tully, has been appointed Assistant Technologist, Bureau of Sugar Experiment Stations, Department of Agriculture and Stock.

Mr. K. V. Henderson, Cotton Field Assistant, Monto, has been appointed Instructor in Cotton Culture.

Mr. F. H. Gilmore, South Johnstone, has been appointed Millowners' Representative on the South Johnstone Local Sugar Cane Prices Board in lieu of Mr. A. A. Moule, resigned.

Mr. H. Le Gay Holthouse has been appointed Assistant Cane Tester at the Invicta Sugar Mill as from 26th July, 1934.

Mr. P. A. Kelly, Inspector of Dairies, Oakey, has been appointed also an Inspector under the Diseases in Stock Acts.

Mr. R. Ferguson, Inspector of Stock, Beaudesert, has been appointed also an Inspector of Dairies.

Mr. W. A. Kearney, Inspector of Stock, Slaughtering, and Dairying, has been transferred from Cloncurry to Mount Isa.

Mr. R. E. Watson, Inspector under the Dairy, Stock, and Slaughtering Acts, has been transferred from Brisbane to Toowoomba.

Pineapples—Maturity and Colour Standards.

A regulation has been issued under the Fruit and Vegetable Act providing for Maturity and Colour Standards for pineapples. In future, matured pineapples shall be fully developed fruit, which, during the months of November to one side at the bottom grooved or relieved to the width and thickness of the lacing sugar content of not less than 12 per cent., and during April to October is quarter yellow coloured at the base and contains a total sugar content of not less than 10 per cent.

The Cheese Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, extending the operations of the Cheese Board from 1st August, 1934, to 7th February, 1935, and extending the term of office of the present members of the Board for a similar period. The members of the Board are:—Messrs. H. T. Anderson (Biddeston), Chairman; T. Dare (Narko), A. J. Harvey (Pittsworth), D. G. O'Shea (Southbrook), A. Pearce (Coalstoun Lakes), and E. Graham (Director of Marketing). No petition was received on the question of the continuance or otherwise of the Board for the period in question.

Pentland a Pure Seed Tobacco District.

An Order in Council has been issued under the Tobacco Industry Protection Act, constituting a Pure Seed District for Tobacco at Pentland. Tobacco is not now grown commercially in this area, and it will be used for the raising of pure seed.

Primary Producers' Organisation and Marketing Acts—Signing of Official Documents.

Regulation No. 77A under the Primary Producers' Organisation and Marketing Acts provides that agreements and official documents connected with the business of a commodity board shall be signed by the Chairman or Deputy Chairman, and countersigned by the Secretary. Occasionally, difficulty has been experienced in obtaining the signature of the chairman or secretary to a paper, owing to the absence of either on leave or business out of the State, and to meet the position a new regulation has been issued to-day, which will provide that documents shall be signed by the chairman or deputy chairman, or in the absence of both by any two members of the Board, and countersigned by the secretary, or in his absence by a member (not being a member who has already signed).

City of Brisbane a Sanctuary under Animals and Bird Acts.

An Order in Council has been issued under the Animals and Birds Acts declaring the City of Brisbane to be a sanctuary for the protection of native animals and birds. It will be an offence, in future, for any person to take or kill any animal or bird within the boundaries of the city of Brisbane.

Amendment of the Dairy Products Stabilisation Act.

An Order in Council, issued under the Dairy Products Stabilisation Act, further amends that Act in certain particulars. A "quota" is now defined to be the proportion of any dairy product manufactured during any stated period by a manufacturer within the State that such manufacturer is permitted to sell in the course of his intrastate trade or commerce in this State.

A "stated period" is defined to include a period of time mentioned in the Act or in any public notice by which a quota is promulgated.

It was previously provided that a quota would remain in force until it was succeeded by a subsequent quota. It is now provided that a quota will remain in force for the period provided for in the notice promulgating it.

It is further provided that the promulgation of a new quota shall not affect the legality of anything done under a previous quota.

It was also provided that no manufacturer should sell in excess of his quota. The amendment of the section relative to this sets out in fuller detail this restriction.

Further amendments provide for business done at Board meetings, and for the fixing of deputies.

Better Boar Subsidy Refund Scheme Terminated—New Scheme in Operation.

The Better Boar Subsidy Refund Scheme in operation over the period, August, 1933, to 30th June, 1934, attracted considerable attention throughout Queensland and resulted in a wide distribution of pedigreed boars in the Large and Middle White breeds, and in increased interest in the development of more extensive outlets for Queensland pork in the markets of the United Kingdom.

This scheme terminated on 30th June, 1934, and has been replaced by a scheme fostered by the Rural Assistance Board of the Agricultural Bank. Under this scheme the Board, acting in co-operation with the Agricultural Bank and Department of Agriculture and Stock, advances on loan 50 per cent. of the landed cost of boars, four months to two years of age, in the following breeds:—Large White, Middle White, Tamworth, and Berkshire.

Forms of application are now available and may be obtained by writing to the Department of Agriculture and Stock, Brisbane, or to the Agricultural Bank. The loan is repayable on easy terms over a period of two years, subject to satisfactory arrangements being completed on receipt of the application form properly completed and accompanied by a fee of 5s., payable to the Rural Assistance Board, Agricultural Bank, Brisbane.

Registration of Stallions.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock), in referring to recently published press statements dealing with the registration of stallions, desires to make it clear that existing legislation definitely prescribes that all stallions three years of age and upwards are required to be produced for examination by the Stallion Board.

Annual certificates are issued to horses of three and four years of age passed as sound and of approved type, and life certificates are granted for approved, sound five-year old horses.

The proposed amendment of legislation would provide for the examination and life certification of sound and approved blood horses at five years of age. If a horse is intended to be used for service prior to that age, it would be necessary to have him produced for examination. The variation proposed will, in effect, exempt all horses in training and under the age of five years from examination under the Stallions Registration Acts, but it would be necessary to produce for examination at one or other of the advertised parades all blood horses of five years of age and upwards not already submitted for examination.

The Minister desires it to be definitely understood that any variation in existing legislation outlined above would not apply to draught stallions.

Barley Board.

Messrs. Edward Fitzgerald, of Felton, and Henry Kessler, Cambooya, have been re-elected unopposed for a further term of one year as from the 1st October next, as members of the Barley Board.

Rural Topics.

Calf-Rearing.

In the rearing of calves it is important that they be fed separately. The practice of feeding in tubs or troughs must be strongly condemned, because it allows the fast drinkers to get too much milk at the expense of the slower ones. It also tends to make young animals drink faster than they should, which gives rise to digestive troubles. Slow drinking should be encouraged, because it allows the milk to combine in proper proportions with the saliva and assures thorough digestion. Proof of this is shown by the fact that slow drinkers always grow best, provided, of course, that they are given their full ration of milk. Moreover, it is impossible to cleanse a trough thoroughly, and as a consequence it is a common cause of scours—more particularly when made of wood or a hollow log.

Money is well spent in the erection of proper yards and bails for calf feeding, much time and temper being saved thereby. Too often there is an entire lack of convenience for this important work which is carried out twice every day.

Nutrition and Wool Growth.

Uniformity and strength of wool fibre depend on adequate nutrition. Malnutrition of the sheep leads to improper function of the wool follicle so that only a slender weak wool fibre is produced. This fibre may be so weak that on the wool coming through the skin it immediately breaks. Thus, any sudden deprivation or lowered nutrition is reflected by a tenderness or actual break in the wool produced at that time. Continued lowered nutrition is accompanied by the production of wool which is finer than normal and tender. Lack of character is often the result of an impaired nutrition.

Thus in drought years wool is what is termed "hungry fine," and is often tender. Sheep which have had their nutrition lowered by attack by internal parasites similarly may produce a tender wool. It may even show a break, this coinciding with the period when the parasites were exerting their greatest effect. Similarly, ewes rearing lambs may show a tender fleece, whereas other ewes of the flock, but not rearing lambs, i.e., dry ewes, have a sound well-grown wool.

Breaks in the wool are also brought about by a sudden change in feed, as, for example, when poverty-stricken sheep are suddenly placed on good feed.

Pig Paddocks and Pastures.

That the pig is instinctively a clean animal and does not require any elaborate or expensive housing or attention is now very well known and appreciated by all who have made a success of the breeding, feeding, and management of this class of live stock.

It is essential to success in rearing pigs that the premises in which they are kept be clean, dry, and free from draughts, and that the pasture over which they graze be clean and well supplied with sufficient herbage of a succulent nature.

Pig houses should not be cramped low or dark and evil smelling, but should be well constructed, be high enough to enable a person to move about inside for purpose of cleansing and care of the stock, and be open to the sunlight to such an extent as to be warm and dry in winter time and cool and airy in the summer.

Portable shelter sheds are much to be preferred for paddock use, also portable feeding floors and troughs, for these enable the paddocks to be kept in good condition, and they eliminate risk of danger to pasture and crops. Careful handling and efficient management go hand in hand, and the successful pig raiser is the one who studies all these features and keeps himself up to date.

These points are emphasised in the pamphlet, "The Pig Farm," by L. A. Downey, Instructor in Pig Raising, now obtainable at the Department of Agriculture and Stock, Brisbane.

Dentition of the Pig.

As a general rule it is not customary in farmyard routine to depend upon inspection of the teeth in deciding upon the age of a pig, although the dentition test may be applied in case of valuable show animals with a fair measure of success. Full particulars in regard to dentition may be obtained by those interested upon application to the Department of Agriculture and Stock.

A full grown pig has twelve incisors or front teeth, six in the upper and six in the lower jaw, and two canine teeth in each jaw. There are also seven molars in each side of the upper and lower jaws, or a total of 44 permanent teeth in all.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

MORE MILK FOR THE CHILDREN.

WE pointed out last month how important it is that our children should take sufficient milk to maintain their health and to insure sturdy development. Every child under six should take one pint daily and every child over six at least half a pint. It would be an immense benefit to the State if our present consumption of milk were doubled. This would also encourage our dairy farmers, a very hard-working class of men (including also their women and I fear often their children), who, we are informed, are in many cases not earning a basic wage.

Excellent milk might be supplied by contract to the schools in Brisbane at a price which would enable every child to have half a pint of milk for a penny with his other school lunch. This would entail no cost to the State. There might even be a small surplus. The distribution of the milk could be performed by senior scholars under the supervision of a teacher. This would be a lesson in order, discipline, and cleanliness. The children as a whole would enjoy better health and be better scholars. The other day a Brisbane mother wrote to us. She says, "I have two young children and pay a shilling a week for 2½ pints. My children have a long walk to school and one, who is studying for the scholarship, has a huge bag of books to lump, so I am reluctant to add bottles of milk. Why are school children so penalised? Why 6d. for 1¼ pints to the school children." Under this scheme her children would receive 2½ pints for 5d., or 5 pints for 10d.

Value of Pasteurised Milk.

The milk would be pasteurised and delivered in bulk. For such milk of excellent quality the Diamantina Hospital pays a little less than 1½d. a pint. Raw milk has often been a vehicle for the spread of infectious diseases. This risk may be prevented either by boiling or by pasteurising. For fifty years and more Brisbane mothers have been in the habit of boiling their milk, and have thereby saved their children from tuberculosis and other diseases derived from cow or the milkers or those who handle the milk. For one thing, tuberculosis of the spine and hipjoint have been much less common here than in the Southern cities, where the milk is boiled only in the hottest months. Therefore it is strange that there should be any prejudice against pasteurised milk, which is just milk that has been heated about half way to boiling point and kept at that heat for about half an hour. Nothing but pasteurised milk is used in the Brisbane Baby Clinics. What is good enough for infants and invalids should be good enough for anybody.

Benefit of a Daily Ration of Milk.

Perhaps it is necessary to quote some authoritative statements. From a leading article in the "British Medical Journal" of 24th February, 1934, we extract the following sentences:—"There is every reason to believe that a daily ration of milk given to children, particularly to those who are living on the borderline of under-nourishment, is likely to exert a beneficial action on their mental and physical development. That a large amount of disease is carried by raw milk is no longer an opinion; it is a fact—a fact as well attested as any in the domain of medical science. There do not appear to be any grounds for the belief that pasteurised milk is a less valuable component of the diet than raw milk for children, who satisfy the bulk of their nutritive requirements from sources other than milk. And again there are strong grounds for the belief that infants can satisfy all their requirements on diets of adequate amounts of pasteurised milk provided that extra vitamin D and of course vitamin C are added to the diet." The last sentence simply means that these infants should take small quantities of a codliver oil emulsion and of orange juice. The Medical Research Council of Great Britain in their report for 1932-33 states that "efficient pasteurisation of milk remains an essential second line of defence in safeguarding human health. The council are not aware of any trustworthy evidence that pasteurisation, if properly carried out, has any seriously damaging effect upon the nutritive qualities of the milk."

The low cost at the Diamantina Hospital depends on the milk being supplied in bulk and not in bottles, for at least half of the retail cost of milk is due to the cost of distribution. It would not be possible to obtain milk at this price, we fear, in our smaller towns, but something should be done there also to supply school children with good and cheap milk. The conditions in these towns are dissimilar and would need special investigation in each case. For the pre-school child the problem is also difficult. Many mothers need to be taught that to give their children only condensed milk or powdered skimmed milk in large quantities of water is a mere pretence of proper nourishment. All children of families on rations should be supplied with milk as a matter of course. This should, we think, be done also in the case of young children of families receiving relief wages.

The Useful Goat.

In country districts conditions vary widely. In dairying districts there is plenty of milk, but some families do not drink it, and their children suffer in consequence. In sugar-growing and fruitgrowing districts every farmer could keep a cow, and have abundance of milk for his family, but many think it too much trouble. Again, there are the dry districts with frequent droughts. Here the health of the children depends mainly on goat's milk, which costs no money in good seasons. Perhaps because it costs nothing when natural feed is plentiful, the goats are allowed to go dry whenever it is scarce. Very few feed their goats, even when mulga can be obtained at no cost, but that of personal exertion. In all these country districts the only thing needed is better education of the mothers.

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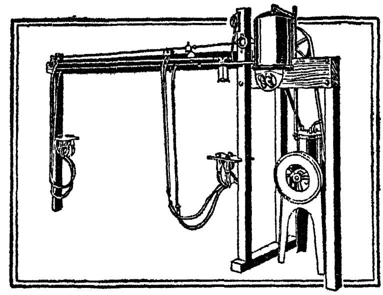

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IN THE FARM KITCHEN.

DRIED FRUITS AND THEIR USES.

Sun-dried fruits were known in olden times, for it is recorded in history that King David of Israel accepted raisins in payment of taxes; and down through the ages we find evidence that sun-preserved fruits were always considered valuable foods.

For health reasons, fruits and vegetables should appear every day in the menu of both young and old. It is not, however, always possible to obtain fresh fruit, and although dried fruits should not altogether take the place of the fresh article, they form an acceptable change in the daily diet. Dried fruits are deficient in vitamin C, but they add so much to the diet in the way of fuel, minerals, laxative properties, and palatibility, that one can easily make up their vitamin deficiency by other foods such as oranges and various raw vegetables.

Cooking Dried Fruits.

The flavour of the fruit is retained when it is cooked by the following method, while much less sugar is required for sweetening if it is added towards the end of the cooking. A few grains of salt will bring out the flavour of stewed apples; the salt should be added towards the end of the cooking.

1. Wash the fruit thoroughly in several waters.
2. Soak overnight in fresh water.
3. Cover the saucepan, and cook slowly until the fruit is tender.
4. Add sugar, if necessary, five minutes before the fruit is cooked.

Some Favourite Recipes.

Steamed Ginger Fig Pudding (serves 8)—1 egg; 1 cup golden syrup; ½ cup melted fat; 1 cup minced figs; 1 cup hot water; 1 tablespoon ground ginger; 1 teaspoon bicarbonate of soda; 2½ cups sifted flour.

1. Beat eggs slightly, and add golden syrup and melted fat.
2. Add minced figs, and beat thoroughly.
3. Sift flour, ginger, and soda together.
4. Add this to the first mixture, alternately with 1 cup of hot water.
5. Beat thoroughly, and turn into a greased covered pudding mould.
6. Steam 3 hours, and serve with lemon sauce.

Lemon Sauce—1 egg; 1 cup sugar; one-third cup melted butter; 1 tablespoon flour; 1 teaspoon lemon extract.

1. Beat egg slightly in the top of a double boiler.
2. Add sugar, butter, and flour.
3. Beat until smooth, then add 1 cup boiling water and cook 5 minutes, stirring frequently.
4. Add lemon extract.
5. Serve hot over pudding.

Peach Coffee Cake—1 cup dried peaches; 2 cups sifted flour; ¼ cup sugar; 4 tablespoons butter; ¾ cup milk; 4 teaspoons baking-powder; ½ teaspoon salt; 2 teaspoons cinnamon; ½ cup yellow sugar; ¼ cup flour.

1. Wash peaches thoroughly, and cook until tender.
2. Remove the skins from peaches, and cut in strips ½ inch wide.
3. Sift 2 cups flour; ¼ cup sugar, baking-powder, and salt.
4. Work in butter with two knives until mixture resembles coarse meal.
5. Add milk gradually while stirring.
6. Beat well and put into a greased shallow pan.
7. Cover the top of the batter with the cut peaches.
8. Cover all with the following mixture:—Cream together 4 tablespoons butter, ½ cup yellow sugar, ¼ cup flour, and 2 teaspoons cinnamon.
9. Bake thirty minutes in a hot oven of 42 deg. F.
10. Serve with custard or any desired sauce.

Apricot Mousse (serves 6 to 8).—Two cups milk; 1 cup sugar; 2 tablespoons flour; 2 cups whipped cream; 2 egg-yolks; 1½ teaspoons gelatine; 1 cup cooked dried apricots.

1. Scald milk in a double boiler.
2. Mix sugar and flour thoroughly, and add to milk.
3. Pour mixture over two beaten egg-yolks, and return to double boiler to cook for two minutes or until mixture coats the spoon.
4. Soak gelatine in one tablespoon of cold water.
5. Add soaked gelatine to hot custard mixture.
6. When mixture is cold, add dried apricots which have been rubbed through a coarse wire sieve.
7. Add whipped cream and freeze.

If the pudding is not to be frozen, but simply set, use 1½ teaspoons of gelatine. —"South African Gardening and Country Life."

CORNISH PASTIES.

Materials.—For filling: ½ lb. topside steak or leg chops; ½ lb. potatoes; 1 small onion; 1 teaspoonful salt; ¼ teaspoonful pepper. For pastry: 6 oz. flour; 3 oz. dripping; ½ teaspoonful baking-powder; ½ gill water.

Utensils—Bowl; sieve; cup; board; rolling-pin; knife; basin, brush; baking tin.

Method—

1. Sift flour, baking-powder, and salt into a bowl.
2. Add dripping; rub it into the flour with the tips of the fingers.
3. Slowly add sufficient water to make dough; turn out on a floured board; knead lightly; cut into four pieces.
4. Roll out each piece into a circle.
5. Wash, peel, and cut potatoes into small cubes; cut meat up small; peel and chop up onion; mix these all well together, adding pepper and salt.
6. Divide into four portions; put one portion on each circle of pastry.
7. Wet half the edge of each circle; fold one-half of each circle over the meat on the other half; pinch the edges together, making a shell-like pattern by twisting the pastry slightly with the thumb and index finger.
8. Brush over with egg or milk; place on a flat tin in a hot part of the oven for 15 minutes; remove to a cooler part and bake for 30 minutes; serve hot.

PLUM PUDDING WITHOUT EGGS.

Materials—½ lb. flour; ¼ lb. suet; ¼ lb. sugar; ¼ lb. stoned raisins; ¼ lb. sultanas; 1 oz. candied peel; 1 teaspoonful mixed spice; ½ nutmeg; 1 teaspoonful carbonate of soda; 1 gill milk; ½ gill warm water.

Utensils—Bowl; sieve; knife; wooden spoon; teaspoon; cup; basin; greased paper or pudding cloth and string; steamer or large saucepan.

Method—

1. Sift flour and salt into a bowl; rub in finely-chopped suet.
2. Add sugar, stoned raisins, sultanas, chopped peel, spice, and nutmeg; mix well.
3. Add the soda dissolved in milk and water; stir until all the ingredients are thoroughly mixed.
4. (*a*) Pour into a well-greased basin; cover with greased paper; steam for 4 hours; or

   (*b*) Pour into the middle of a pudding cloth wrung out of boiling water and sprinkled with flour; tie up securely; put the pudding into a saucepan three parts full of boiling water; boil for 3½ hours.
5. Turn out on a hot dish; serve with boiled custard.

Note—For a date or fig pudding use cut-up dates or figs instead of sultanas, raisins, and candied peel, omit spice and nutmeg, and use ½ teaspoonful instead of 1 teaspoonful of carbonate of soda.

FRITTERS.

Materials—4 oz. flour; 1 dessertspoonful butter; white of 1 egg; 1 gill of warm water; dripping for frying; 8 small slices of cold cooked meat or fruit; 3 sprigs of parsley or 1 tablespoonful of sugar.

Utensils—Bowl; sieve; wooden spoon; small saucepan; basin; whisk; skewer; fish kettle or large saucepan; brown paper; dish.

Method—

1. Sift flour and salt into a bowl; make a well in the middle.
2. Pour in melted butter; add warm water slowly; stirring carefully until the flour, butter, and water are mixed into a batter.
3. Add the white of egg beaten to a stiff froth; stir gently.
4. Lift a slice of meat or fruit on a skewer; dip it into the batter; when completely covered drop it into deep hot smoking fat; repeat as often as necessary, watching those put into the fat first.
5. The fritters should float, and must be turned quickly when browned on the under side.
6. When golden brown all over lift them out on a skewer and drain them on paper.
7. Arrange piled up on a hot dish; if made with meat, garnish with parsley; if with fruit, sprinkle with sugar.

Notes—

1. Meat for fritters must be cooked, freed from fat and gristle, and cut into slices no thicker than ¼ inch
2. Bananas must be cut into slices lengthways.
3. Apples must be peeled and cut into slices ⅜ inch thick across the core; the core must be cut out with a corer; the slices should be put into a shallow pan of boiling water and boiled for 3 minutes; a skewer should be used to turn the slices, and care must be taken not to break them.
4. Pineapples must be peeled and cut into slices ⅜ inch thick; the eyes and core must be carefully removed without breaking the slice; if the pineapple is very large the slices should be halved or quartered.

TRIPE AND ONIONS.

Materials—1 lb. tripe; 2 onions; 1 cup milk; 1 tablespoonful flour; salt and pepper; 1 dessertspoonful chopped parsley.

Utensils—Bowl; knife; 1 quart saucepan; 1 pint saucepan; colander or strainer; wooden spoon; basin; dish.

Method—

1. Wash the tripe in warm water; cut away the fat; cut tripe in small pieces.
2. Put the pieces into a saucepan; add enough cold water to cover tripe; put the saucepan on the fire.
3. Boil for 5 minutes; remove from fire; strain off water.
4. Peel and slice onions; put them into a saucepan; add enough cold water to cover them; bring to boiling point; strain off water.
5. Put the parboiled onions into the saucepan with the tripe; cover with cold water; boil till the tripe is tender; strain away half the water.
6. Add milk; bring to boiling point; thicken with flour blended with cold milk; boil for 5 minutes; season with salt and pepper.
7. Serve on a hot dish; sprinkle chopped parsley over the tripe before sending the dish to the table.

STEAK AND KIDNEY PUDDING.

Materials—For pastry: 6 oz. flour; 3 oz. suet; ½ teaspoonful baking-powder; ½ teaspoonful salt; ½ gill water. For filling: 1 lb. steak; 2 sheep's kidneys; 1 slice bacon; 1 tablespoonful flour; 1 teaspoonful salt; ¼ teaspoonful pepper; 1 teaspoonful chopped onion.

Utensils—Board; rolling-pin; bowl; sieve; knife; basin; cup; greased paper and steamer, or pudding cloth and string; large saucepan.

Method—

1. Sift flour, salt, and baking-powder into a bowl.
2. Rub in finely-chopped suet; work into a paste with water; turn out on a floured board; knead lightly.
3. Roll out to the thickness of ¼ inch; line a well-greased basin with part of the pastry.
4. Cut steak, kidneys, and bacon into small pieces; roll pieces in flour, pepper, and salt.
5. Put pieces in layers into the lined basin; sprinkle each layer with minced onion; pour in enough water to come up to 1 inch from the edge of the basin.
6. Cover with pastry; trim the edges with a sharp knife, cutting downwards; pinch the edges of the lining and covering pastry together.
7. (*a*) Cover the pudding with greased paper; steam it for 3 hours; or

   (*b*) Sprinkle with flour the middle of a pudding cloth wrung out of boiling water; tie the pudding cloth securely over the top of the pudding; put the pudding into a saucepan three parts full of boiling water; boil for 2½ hours.
8. Since the pudding cools quickly, it should be served in the basin in which it is cooked; a serviette should be pinned round the basin, and the basin placed on a dish before it is sent to the table.

LEMON MERINGUE.

Materials—½ pint milk; 1 cup bread crumbs; 2 eggs; 1 tablespoonful butter; 3 tablespoonfuls sugar; the grated rind and juice of 1 small lemon.

Utensils—Saucepan; basin; cup; plate; whisk; pie dish; grater; squeezer.

Method—

1. Put the milk into a saucepan; bring it to the boil; put bread crumbs into a basin.
2. Pour the boiling milk over the crumbs; add grated lemon rind, butter, and half the sugar; mix well; allow to cool.
3. Separate the yolks and whites of eggs; beat the yolks well; add them to the cooled mixture in the basin.
4. Pour the mixture into a well-greased pie dish; bake in a moderate oven until the pudding is set but not browned.
5. Whisk the white to a firm froth; add lemon juice and the remainder of the sugar, making a stiff meringue.
6. Pour the meringue over the pudding; return it to the oven till the meringue is set and slightly browned.

POTATO SCONES.

Materials—1 lb. boiled potatoes, sweet or English; 1 teaspoonful salt; 3 tablespoonfuls flour; ½ gill water.

Utensils—Board; rolling-pin; knife; cup; frying-pan or girdle.

Method—

1. Mash cold boiled potatoes; add salt and flour.
2. Mix well; add enough water to make the mixture into a dough.
3. Roll out to the thickness of ¼ inch; cut into squares or triangles.
4. Heat a girdle or frying-pan; sprinkle it with flour.
5. When the flour turns a creamy colour put the scones on the hot pan.
6. Cook for about 5 minutes; turn; cook the other side until it is slightly browned.

PRUNING OF TREES AND SHRUBS.

The following hints on the pruning of trees and shrubs were given by the Superintendent of the Botanic Gardens, Sydney, in the course of a paper read at the recent Central Coast conference of the Agricultural Bureau of New South Wales.

The object of pruning trees is to regulate the growth so that shapely specimens may develop. The first important matter in the pruning and training of young trees for specimens is to see that they are developed on a single straight stem or bole. This is done by seeing that the leading shoot is in no way injured, and is allowed to develop unhampered, by, if necessary, cutting away any side shoots that appear to be rivalling the main shoot for leadership. Where a clean bole is required for a certain height, the lower branches should be gradually cut away as the plant grows. Avoid cutting away too much at any one time, and try to do any cutting before the side branches are too large, because each cut makes a wound and the larger the wound the more likely, unless properly treated, that decay or disease will make its appearance. The top also may require a little thinning and shaping in the early stages to balance the tree.

In dealing with older trees where through accident or other cause it becomes necessary to remove some of the larger branches, the cut thus made, being a large one, should be properly treated at once, otherwise it becomes a settling place for parasitic diseases. When removing a large branch, do not attempt to cut it all away in one large piece, unless of course you have it slung; if you do you will probably find that its weight will tear away a portion you do not want injured and offer further harbour for parasites.

All limbs and large branches should be sawn off close to the trunk so that no stump, which will probably die back into the heart of the tree before the trouble is noticed, is left. If sawn off close to the trunk with a clean cut at about the level of the surrounding bark, the bark will eventually cover the wound, or at any rate form a callous around it and to a certain extent prevent decay.

Any cuts made should be treated immediately after being made with either gas or Stockholm tar or some such mixture, thus sealing the raw surface and protecting it from disease. This wound should be periodically treated if it shows signs of cracking or opening up.

Their pruning is one of the most important phases in the growing of shrubs. The art of pruning as applied to ornamental as well as flowering shrubs may be said to serve one or more of the following purposes—(1) To improve or alter the shape of the plant; (2) to increase the quantity or quality of the blossoms; or (3) to bring about an improvement in the health of the plant. Therefore its proper practice necessitates an intimate knowledge of the habits and nature of the subject to be operated on. For instance, a collection of flowering shrubs, in so far as they need pruning at all, cannot be pruned properly unless the workman knows the time of flowering of each one and other little peculiarities of growth.

Although the winter months are looked upon as the time for general pruning it must not be taken for granted that all shrubs can be pruned then. A very good rule with regard to all flowering shrubs is to prune at such a season as will allow of the fullest possible period of growth before the next flowering season comes around.

Those shrubs on which flowers are borne on the growth of the current year should be pruned in the winter before the growth commences. The previous year's wood may, if necessary, be cut hard back to make the plant more shapely. Then there are those that flower on the previous season's growth. These should not be cut back until immediately after flowering, which takes place in the spring or early summer months.

A few points to remember when pruning, assuming one knows the habits of the plants, are as follows:—Cut out all weak and spindly growth, and shorten back growths where necessary, but not in a formal fashion by just clipping the plant all around. Show as few cuts as possible and leave the plant in as natural shape as you can. Many of our deciduous shrubs and a few of the evergreens will stand cutting right back to the ground if circumstances demand such drastic action.

THE GARDEN COMPOST HEAP.

The garden compost heap is a cheap means of converting garden and household vegetable refuse into valuable fertilizing material. Materials such as lawn clippings, spent crops free of disease, vegetable tops, &c., should all be used in this manner, but the coarse, woody stalks of strong-growing plants should not be used.

The production of artificial manure from garden waste, straw, &c., consists in the decomposition, by fungi and bacteria, of much of the plant material. The nitrogen in the process is converted from an inorganic to an organic form, and is

present in increased amount in the material finally produced. The rapidity with which the process goes on is influenced by the type of material, its degree of maturity and chemical composition, and by the presence of nutrients such as lime, phosphate, nitrogen, and potash, for the organisms carrying on the decomposition are much akin to plants in their requirements.

Actual damage can be done to crops, other than some legumes, by the addition of uncomposted, poor-quality material to the soil. This damage is due largely to a lack of available nitrogen in the soil. Such poor-quality materials as bush scrapings, dry mature grass or straw, offer a good source of energy for the soil bacteria and fungi, which rapidly increase in numbers, and in so doing consume all the available nitrogen. This competition for soil nitrates results in the nitrogen starvation of crop plants.

The usual process of allowing plant refuse to decay without any chemical treatment results in a very acid product, providing no immediately available nitrogen. With nitrogen-poor plant residues it becomes necessary to add available nitrogen to the heap, as well as lime, which prevents the development of acidity, and prosphate, which is required in the nutrition of the organisms. With nitrogen and mineral-rich materials such as legumes (peas, beans, &c.), green vegetable tops, and other green succulent material, the use of lime alone should be sufficient to enable rapid decomposition.

With general refuse or poor-quality material, a heap can be made on a square base, and of such size that the final height is about 3 feet. Spread the chopped-up material in layers several inches deep, treating each layer in the following manner:—

Snow over with ground limestone (5 lb. per 100 lb. material), fork in loosely, give a sprinkling of superphosphate, and then add sulphate of ammonia at the rate of 1½ lb. per 100 lb. material. The material should be moistened before building up the layers, if not already moist. Ammonia may be given off slowly, so that it is necessary to keep building up and treating the successive layers quickly, so that it will not be lost. The final layer is not treated, and may be given a covering of an inch of soil. When next the heap is added to, the untreated layer can be moistened and treated.

When the heap is at the full height, after subsidence due to compaction and loss of material by bacterial action, the heap can ferment under the untreated capping, which can be used as a base for the next heap. The heap should be kept damp, but water should not be added in quantity sufficient to cause drainage from the heap.

In summer the material should be ready for use after two months, but in cold weather the process is much slower.

Artificial manure properly prepared is very similar in chemical composition to composted horse manure, and gives equally good results in promoting plant growth.

FERTILITY OF THE HOME GARDEN.

Intensive gardening demands a higher degree of soil fertility than does ordinary field crop culture. An efficient system of soil management should not only make allowance for the present crop, but should aim at an ever-increasing reserve of fertility. It should determine the necessity and value for the particular soil of organic matter, how most economically to apply this material, then attempt to supplement this where necessary, by liming and the addition of artificial fertilizers.

Organic matter has an important function in the growth of plants as a source of carbon dioxide, in improving the physical condition of the soil, in increasing the water-holding capacity, allowing root penetration, and modifying extremes of soil temperature. In addition to providing some of the mineral constituents required in greatest amount, organic matter provides certain rare and little understood elements, usually not considered in the preparation of artificial fertilizers. Heavy soils in which the fine particles accumulate in large masses, and crack badly on drying, can only be improved in texture by liming when acid, and the addition of organic matter to prevent the clods from cementing.

In general, the richer the food of animals in fertilizing substances the richer their excreta, particularly the liquid portion. This contains most of the potash and a great deal of the nitrogen, but only a small amount of the phosphate which passes through their bodies; further, it contains these substances in a form

ready for the immediate use of the plant. It is therefore important to realise that unless precautions have been taken to include it with the solid excreta, most of the valuable fertilizing constituents have been lost.

The kind of animal affects the fertilizing value of manure. Horse manure is richer and more readily decomposed than cow manure, since the mineral requirements of the milking cow are much greater than those of the horse. Poultry manure, when fresh, is a rich fertilizer compared with horse or cow manure; it contains more than twice as much nitrogen and phosphate, but has only about the same amount of potash. The bulk of its nitrogen is present in an easily available form, hence it is a quick-acting or forcing nitrogenous manure.

Animal manure as commonly procurable has not been carefully conserved against the loss of fertilizing constituents, and unless the liquid portion has been included, a considerable portion of the nitrogen present is not of use to plants. It must be regarded as an unbalanced fertilizer, and the fertilizer balance can be greatly improved by the separate use of superphosphate, and sulphate or chloride of potash.

Where the organic matter of the soil is maintained by using manure, a degree of fertility will be maintained, but an annual application of 100 to 150 lb. per 100 square feet will be necessary.

LIME FOR THE GARDEN.

Lime fulfils many functions which are essential to soil fertility. Its most useful action is in neutralising the acidity of strongly acid soils, for with the removal of acidity the other valuable effects of liming follow. Lime improves the physical condition of heavy acid soils, ensuring better drainage and aeration, and making cultivation easier, and is an essential plant nutrient, and when present in sufficient amount promotes many phases of bacterial activity, especially those ultimately bringing the reserves of nitrogenous material in the soil into the soluble forms of nitrogen which plants utilise.

There is no foundation for the common statement that exposure of acid soil to sun and air "sweetens" or reduces its acidity. Acidity is developed through an insufficiency of lime in the original soil-forming material, or by the loss of lime, through leaching, and absorption by plants. Acidity thus developed can only be counteracted in field or garden practice by the use of some form of lime. The forms of lime used for counteracting soil acidity are hydrated or slaked lime, and ground limestone or carbonate of lime.

Slaked lime is formed by the action of water on burnt or stone lime, and forms a very fine powder which can be efficiently spread. Ground limestone is a cheaper and more pleasant material to handle than slaked lime, and can nearly always be relied on to give as quick and good results as slaked lime, provided the material is sufficiently fine and well distributed, and that equivalent dressings are applied. In the last respect, 4 lb. of carbonate of lime are required to supply as much "effective" lime as 3 lb. of slaked lime contains.

The soil to be limed should be dug over and reduced to good tilth, the lime uniformly spread, and then lightly worked into the top several inches of soil. The amount of lime to be used depends on the degree of acidity of the soil, its texture, organic matter content, and the type of plant to be grown. Unless all these features can be determined, suggestions on the amount of lime that it is necessary to add to a soil can only be approximate.

On loams and heavier soils, dressings may range from 1 lb. of slaked lime, or 1⅓ lb. ground limestone, per square yard on loams, to double these quantities on clay loams and clays. Sandy loams or still more sandy soils can receive lighter dressings of approximately half the amount for loams. Lime is lost most rapidly from sandy soils, which are usually more acid than heavier soils under the same conditions. Under garden conditions, with frequent waterings, lime is continually being lost, especially from the sandier types of soil. After the initial liming, which may need to be heavy to counteract strong acidity, it is preferable to add light dressings each season, rather than occasional heavy dressings.

It is not always necessary to add sufficient lime to completely neutralise soil acidity, as most garden plants grow well on slightly acid soils. This slightly acid condition will only result in the majority of garden soils after liming. Only

for those plants listed below as very sensitive to acidity is it advisable to completely neutralise acidity. Whilst many plants grow best on neutral soils or on slightly alkaline (opposite of acid) soils, a considerable number of plants will tolerate fairly acid soils. The latter are not adversely affected by being grown in limed soils, though many plants which require a good lime supply may fail on acid soils.

By careful planning of the garden cropping scheme, portion of the area may be set apart and only lightly limed, if at all, for certain plants (as indicated below), and the remainder limed for those crops with a higher lime requirement. Potatoes, which will grow on acid soils, do best on slightly acid soils, and in gardens where dry conditions are not experienced the danger from scab diseases in slightly acid soils is small.

The following statement shows the relative sensitiveness of a number of garden and crop plants to acid soil conditions:—

Very Tolerant.—Parsley, potato, radish, strawberry, sweet potato, tomato, cowpea, maize, millet, oats, rye.

Tolerant.—Bean, Brussels sprouts, carrot, choko, cucumber, endive, khol rabi, pea, pumpkin, rhubarb, squash, turnip, watermelon, crimson clover, vetch.

Sensitive.—Broccoli, cabbage, cauliflower, eggplant, sweet corn, barley, rape, red clover, sweet clover, wheat, white clover.

Very Sensitive.—Asparagus, beet, celery, lettuce, onion, parsnip, spinach, lucerne.

Evidence is available to show that excess of lime under certain conditions may depress plant growth. Overliming may result when the calculated amount of lime is applied to the surface zones of soil, and not worked to the proper depth. Overliming injury is produced only on heavily-limed acid soils, and not on non-acid soils, or soils which have previously been limed. This injury is not permanent and is usually overcome by the time the first crop is removed. Lettuce and lucerne are crops which may suffer from bad lime distribution.

Large additions of organic matter such as compost, manure, &c., are very effective in reducing overliming injury, and this fact is of importance in indicating that a liberal addition of green or stable manure should be applied to the soil if immediate liming and seeding are necessary. Where very heavy dressings of lime are necessary, it may be advisable to apply lime in two successive seasonal applications. After the preliminary liming, the lime added in a well-made compost will go far to counteract natural losses of lime from the soil.

TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

Orchard Notes for October.

THE COASTAL DISTRICTS.

OCTOBER is frequently a dry month over the greater part of Queensland, consequently the advice that has been given in the notes for August and September regarding the necessity of thorough cultivation to retain moisure is again emphasised. Unless there is an adequate supply of moisture in the soil to meet the trees' requirements, the coming season's crop will be jeopardised, as the young fruit will fail to set.

Thorough cultivation of all orchards, vineyards, and plantations is therefore imperative if the weather is dry, as the soil must be kept in a state of perfect tilth, and no weeds of any kind must be allowed to grow, as they only act as pumps to draw out the moisture from the soil that is required by the trees or fruit-yielding plants. Should the trees show the slightest sign of the want of moisture, they should be given a thorough irrigation if there is any available means of doing so, as it is unwise to allow any fruit trees to suffer for want of water if there is a possibility of their being supplied. Intermittent growth, resulting from the tree or plant being well supplied with moisture at one time and starved at another, results in serious damage, as the vitality is lessened and the tree or plant is not so well able to ward off disease. A strong, healthy, vigorous tree is frequently able to resist disease, whereas when it has become debilitated through neglect, lack of moisture or plant food, it becomes an easy prey to many pests. If an irrigation is given, see that it is a good one and that the ground is soaked; a mere surface watering is often more or less injurious, as it is apt to encourage a false growth which will not last, and also to bring the feeding roots to the surface, where they are not required, as they only die out with a dry spell and are in the way of cultivation. Irrigation should always be followed by cultivation, so as to prevent surface evaporation and thus retain the moisture in the soil.

All newly planted trees should be carefully attended to, and if they show the slightest sign of scale insects or other pests they should receive attention at once. All growth not necessary to form the future tree should be removed, such as any growths on the main stem or main branches that are not required, as if this is done now it will not only save work later on, but will tend to throw the whole strength of the tree into the production of those limbs that will form the permanent framework of the tree. In older trees all water sprouts or other similar unnecessary growths should be removed.

Keep a good lookout for scales hatching out, and treat them before they have become firmly established and are coated with their protective covering, as they are very easily killed in their early stages, and consequently much weaker sprays can be used. The best remedies to use for young scales hatching out are those that kill the insects by coming in contact with them, such as miscible oils, which can be applied at a strength of 1 part of oil in 40 parts of spraying material, and will do more good than a winter spray of double the strength. In the use of miscible oils or kerosene emulsion, always follow the directions given for the use of those spraying materials, and never apply them to evergreen trees when they are showing signs of distress resulting from a lack of moisture in the soil, as they are then likely to injure the tree, whereas if the tree is in vigorous growth they will do no harm whatever.

All leaf-eating insects should be kept in check by the use of an arsenate of lead spray, taking care to apply it as soon as the damage appears, and not to wait till the crop is ruined. Crops, such as all kinds of cucurbitaceous plants, tomatoes, and potatoes are often seriously injured by these insects, and the loss occasioned thereby can be prevented by spraying in time. In the case of tomatoes and potatoes, a combined spray of Bordeaux or Burgundy mixture and arsenate of lead should be used, as it will serve the dual purpose of destroying leaf-eating insects and of protecting the plants from the attack of Irish blight.

Grape vines require careful attention, and, if not already sprayed with Bordeaux mixture, no time should be lost in applying this material, as the only reliable method of checking such disease as anthracnose or black spot and downy mildew is to protect the wood and foliage from the attack of these diseases by providing a spray covering that will destroy any spores that may come in contact with them. The planting of bananas and pineapples can be continued during the month. See that the land is properly prepared and that good, healthy suckers only are used. Keep the plantations well worked, and allow no weed growth. Keep a very careful

lookout for fruit flies; destroy every mature insect you can, and gather and destroy every fallen fruit. If this is done systematically by all growers early in the season the subsequent crop of flies will be very materially decreased. See that all fruit sent to market during the month is carefully handled, properly graded, and well packed—not topped, but that the sample right through the case or lot is the same as that of the exposed surface.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

MUCH of the matter contained under the heading of "The Coastal Districts" applies equally to these parts of the State; for on the spring treatment that the orchard and vineyard receives the succeeding crop of fruit is very largely dependent. All orchards and vineyards must be kept in a state of perfect tilth, and no weed growth of any kind should be allowed. In the western districts, irrigation should be given whenever necessary, but growers should not depend on irrigation alone, but should combine it with the thorough cultivation of the land so as to form and keep a fine soil mulch that will prevent surface evaporation.

All newly planted trees should be carefully looked after, and only permitted to grow the branches required to form the future tree. All others should be removed as soon as they make their appearance. If there is any sign of woolly aphis, peach aphis, or scale insects, or of any fungus disease on the young trees, these diseases should be dealt with at once by the use of such remedies as black leaf forty, Bordeaux mixture, or a weak oil emulsion. In older trees, similar pests should be systematically fought, as if kept in check at the beginning of the season the crop of fruit will not suffer to any appreciable extent. Where brown rot has been present in previous years, two or more sprayings with Bordeaux mixture can be tried, as they will tend to check other fungus growths, but at the same time the sodium or potassium sulphide sprays are more effectual for this particular disease and should be used in preference when the fruit is nearly full grown. All pear, apple, and quince trees should be sprayed with arsenate of lead—first when the blossom is falling, and at intervals of about three weeks. Spraying for codlin moth is compulsory in the fruit district of Stanthorpe, and wherever pomaceous fruit is grown it must be attended to if this insect is to be kept in check.

In the warmer parts a careful check should be kept for any appearance of the fruit fly, and, should it be found, every effort should be made to trap the mature insect and to gather and destroy any affected fruit. If this is done, there is a good chance of saving the earlier ripening summer fruit, if not the bulk of the crop. Tomato and potato crops will require spraying with Bordeaux mixture, as also will grape vines. Keep a very strict watch on all grape vines, and, if they have not already been treated, don't delay a day in spraying if any sign of an oil spot, the first indication of downy mildew, appears on the top surface of the leaf. Spraying with Bordeaux mixture at once, and following the first spraying up with subsequent sprayings, if necessary, will save the crop, but if this is not done and the season is favourable for the development of the particular fungus causing this disease, growers can rest assured that their grape crop won't take long to harvest.

Where new vineyards have been planted, spraying is also very necessary, as if this is not done the young leaves and growth are apt to be so badly affected that the plant dies.

Farm Notes for October.

FIELD.—With the advent of warmer weather and the consequent increase in the soil temperature, weeds will make great headway if not checked; therefore, our advice for last month holds good with even greater force for the coming month. Earth up any crops which may require it, and keep the soil loose among them. Sow maize, cowpeas, sorghums, millet, panicums, pumpkins, melons, cucumbers, marrows. Plant sweet potatoes, yams, peanuts, arrowroot, turmeric, chicory, and ginger. Coffee plants may be planted out. There are voluminous articles in previous journals giving full instructions how to manage coffee plants from preparing the ground to harvesting the crop, to which our readers are referred.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JULY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING JULY, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	July.	No. of Years' Records.	July, 1934.	July, 1933.
North Coast.	In.		In.	In.
Atherton	1·00	33	1·61	0·94
Cairns	1·56	52	1·25	0·58
Cardwell	1·37	62	1·38	3·18
Cooktown	0·97	58	0·25	0·74
Herberton	0·85	48	1·43	1·12
Ingham	1·52	42	3·16	3·24
Innisfail	4·60	53	5·29	4·08
Mossman Mill ..	1·23	21	1·71	1·23
Townsville	0·61	63	0·81	1·27
Central Coast.				
Ayr	0·69	47	0·52	2·07
Bowen	0·96	63	0·32	5·19
Charters Towers ..	0·62	52	0·69	1·53
Mackay	1·72	63	0·59	10·08
Proserpine	1·59	31	1·65	9·29
St. Lawrence ..	1·39	63	0·68	11·38
South Coast.				
Biggenden	1·34	35	2·13	3·61
Bundaberg	1·80	51	1·45	4·33
Brisbane	2·25	83	5·11	3·24
Caboolture	2·14	47	4·47	4·39
Childers	1·67	39	1·40	3·94
Crohamhurst ..	2·88	41	6·16	6·39
Esk	1·95	47	3·15	3·14
Gayndah	1·45	63	2·03	3·71
Gympie	2·10	64	2·64	3·60
Kilkivan	1·60	55	2·72	3·03
Maryborough ..	1·88	63	2·17	3·30
Nambour	2·65	38	4·05	5·10
Nanango	1·64	52	3·26	2·27
Rockhampton ..	1·77	63	0·42	19·52
Woodford	2·35	47	3·86	4·70

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	July.	No. of Years' Records.	July, 1934.	July, 1933.
Central Highlands.	In.		In.	In.
Clermont	1·02	63	0·33	6·82
Gindie	1·09	35	..	8·44
Springsure ..	1·17	65	1·17	9·63
Darling Downs.				
Dalby	1·72	64	2·78	2·57
Emu Vale ..	1·54	38	3·16	1·97
Hermitage ..	1·71	28	..	2·19
Jimbour	1·53	46	1·85	2·46
Miles	1·62	49	2·50	3·25
Stanthorpe	2·02	61	3·44	2·41
Toowoomba ..	2·08	62	3·81	5·53
Warwick	1·82	69	3·44	2·54
Maranoa.				
Roma	1·47	60	1·63	5·04
State Farms, &c.				
Bungeworgorai ..	1·43	20	1·47	4·61
Gatton College ..	1·36	35	2·85	2·91
Kairi	1·12	20	0·97	1·05
Mackay Sugar Experiment Station	1·55	37	0·60	9·64

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JULY, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means.		Shade Temperature. Extremes.				Rainfall.	
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·96	79	63	84	28	51	20	25	2
Herberton	..	69	54	76	30, 31	41	8, 20	143	13
Rockhampton	30·11	74	53	81	11	42	7, 8	42	5
Brisbane	30·13	68	52	78	10	42	9	511	9
Darling Downs.									
Dalby	30·16	65	43	75	10	32	20	278	7
Stanthorpe	..	57	37	66	10	23	20, 21	344	10
Toowoomba	..	60	43	71	10	31	20	381	10
Mid-Interior.									
Georgetown	29·99	83	56	91	25	42	6	Nil	..
Longreach	30·11	73	46	81	10	37	6	155	4
Mitchell	30·16	65	40	77	10	28	21	161	5
Western.									
Burketown	30·02	81	57	85	1, 10, 15–18, 24	50	9, 22	Nil	..
Boulia	30·11	70	46	84	9	41	21, 29	148	3
Thargomindah	30·14	64	44	77	15	36	23	50	3

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	September, 1934.		October, 1934.		MOONRISE. Sept. 1934.	MOONRISE. Oct., 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6·7	5·37	5·33	5·51	12·21	12·50
2	6·6	5·37	5·32	5·52	1·17	1·35
3	6·5	5·38	5·31	5·53	2·9	2·13
4	6·4	5·38	5·29	5·54	2·54	2·45
5	6·3	5·39	5 28	5·55	3·38	3·17
6	6·2	5·39	5·27	5·56	4·14	3·46
7	6·1	5·40	5·26	5·56	4·46	4·15
8	6·0	5·40	5·25	5·57	5·18	4·46
9	5·59	5·41	5·24	5·57	5·46	5·17
10	5·57	5·41	5 23	5·57	6·14	5·31
11	5·56	5·42	5·22	5·58	6·44	6·30
12	5·55	5·42	5·21	5·58	7 13	7·14
13	5·53	5·43	5·20	5·58	7·47	8·6
14	5·52	5·43	5·19	5·59	8·28	9·4
15	5·51	5·44	5·18	5·59	9·15	10·9
16	5·50	5·44	5·17	5·59	10·9	11·13
						p.m.
17	5·49	5·44	5·16	6·0	11·11	12·21
					p.m.	
18	5·48	5·45	5·15	6·0	12·16	1 28
19	5·46	5·45	5·14	6·1	1·23	2·32
20	5·45	5·46	5·12	6·2	2·33	3·38
21	5·44	5·46	5·11	6·2	3·42	4·38
22	5·43	5·47	5·10	6·3	4·47	5·40
23	5·42	5·47	5·9	6 3	5·52	6·46
24	5·41	5·47	5·8	6·4	6·59	7·52
25	5·40	5·48	5·7	6·5	8·3	8·59
26	5·39	5·48	5·6	6·6	9·6	9·48
27	5·37	5·49	5·6	6·6	10·8	10·42
28	5·36	5·49	5·5	6·7	11·6	11·28
29	5·35	5·50	5.4	6.7	12·0	a.m.
30	5 34	5 50	5·4	6·8	..	12·10
31			5·3	6·9	..	12·45

Phases of the Moon, Occultations, &c.

1 Sept.	☽	Last Quarter	5 40 a.m.
9 ,,	●	New Moon	10 20 a.m.
16 ,,	☾	First Quarter	10 26 p.m.
23 ,,	○	Full Moon	2 19 p.m.
30 ,,		Last Quarter	10 29 p.m.

Apogee, 5th September, at 4.6 p.m.
Perigee, 21st September, at 11.6 a.m.

At 5 p.m. on the 12th the crescent Moon will be passing from west to east of Jupiter, which will be at a distance of 7 degrees to the north of it. The Moon and Jupiter will be high up in the north-west, coming into view an hour later.

An occultation of Antares will occur on 15th September, which will be more noticeable in the far west of Queensland than on the eastern coast, where the Moon and star will be on or near the western horizon, setting a little before midnight.

When Jupiter sets at 7.30 p.m. on the 29th the rapidly moving planet Mercury will follow it about 6 minutes later. The nearness of the two planets to one another will be noticeable half an hour or more before they disappear, the Sun having set at 5.50.

An interesting spectacle for observers with a telescope would have been afforded about a quarter past 5 a.m. for several mornings, especially on the 21st, by the apparent nearness of Venus and Neptune, then being only half a degree apart (a distance equal to the width of the Moon), if it had not been for the increasing daylight, sunrise being at 5.44.

Mercury sets 23 minutes after the Sun on the 1st; on the 15th it sets at 6.53 p.m., one hour after the Sun.

Venus rises at 5.7 a.m. on the 1st, and at 5.6 a.m. on the 15th.

Mars rises at 4.8 a.m. on the 1st and at 3.46 a.m. on the 15th.

Jupiter sets at 8.46 p.m. on the 1st and at 8.13 p.m. on the 15th.

Saturn rises at 4.25 p.m. and sets at 5.37 a.m. on the 1st; on the 15th it rises at 3.11 p.m. and sets at 4.38 a.m.

When the Southern Cross comes into view soon after sunset on the 1st, it will be noticeably curving downwards towards its greatest western elongation, indicated by III. on the clockface, which it will reach at 8 p.m. if the observer is near the 150th meridian. It will then be 30 degrees from the South Celestial Pole, after which it will continue to curve downwards till 2 a.m., when it will reach position VI. and be due south. In this position it becomes lost in Queensland, not reappearing till the following evening, when the positions mentioned will be reached 4 minutes earlier.

9 Oct.,	●	New Moon	1 5 a.m.
16 ,,	☾	First Quarter	5 29 a.m.
23 ,,	○	Full Moon	1 1 a.m.
30 ,,	☽	Last Quarter	6 22 p.m.

Apogee, 3rd October, at 7.54 a.m.
Perigee, 19th October, at 12.18 a.m.
Apogee, 31st October, at 3.24 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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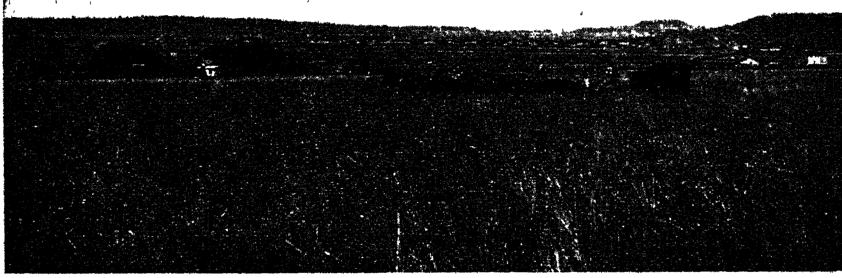
QUEENSLAND AGRICULTURAL JOURNAL



VOL XLII. 1 OCTOBER, 1934. PART 4.

Event and Comment.

Fruit-Fly Control.

AS a consequence of resolutions passed by the mass meeting of fruit-growers at Stanthorpe on Wednesday, the 26th September, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock), who attended the meeting, has announced that instructions have been issued to fruit inspectors in the Stanthorpe district to enforce rigidly the new regulations for the control of fruit fly during the coming season. The new measures will apply to the Stanthorpe, Warwick, and Killarney districts. Six additional inspectors will patrol these districts during the next five months, and action will be taken against those persons, including householders with fruit trees growing in their back yards, who neglect to carry out the requirements of the Department in respect of fruit fly control. For the information of householders, Mr. Bulcock added that the term "orchard" was defined by the Diseases in Plants Act as "any place where one or more fruit-producing plants are growing."

The new regulations provide—

(*a*) That fruit-fly traps charged with lure must be forthwith placed in every orchard in the districts concerned at the rate of one trap per acre, or part thereof.

(*b*) In the case of cherries and other early fruits, traps at the rate of ten per acre must be placed in the trees immediately.

(c) In the case of all fruits maturing before the 1st January, 1935, traps must be placed in position by the 15th November next at the rate of ten traps per acre.

(d) In the case of all fruits maturing before the 1st February, 1935, traps at the rate of ten per acre must be placed in position by the 15th December, 1934.

(e) In the case of fruits maturing after the 1st February, 1935, traps at the rate of ten per acre must be in position by the 1st January.

The traps must be cleaned out and charged with fresh lure twice per week.

It is to be hoped, added the Minister, that in this special effort to control fruit fly in our main deciduous fruit-growing areas, all persons who have fruit trees growing will co-operate with the Department in the carrying out, both in the spirit and letter, of these regulations.

A Story of Remarkable Development.

A STORY of remarkable development and prosperity in North Queensland was told by the Deputy Premier (Hon. P. Pease) on his return from a recent visit that took him as far as Cooktown. "From Mackay northwards there has been immense development in agriculture, and on all sides I saw unmistakable signs of progress and confidence," he said.

He had noticed that a transition period in the history of North Queensland was taking place. For many years the settlers north of Mackay had been loath to engage in anything but sugar farming. They naturally thought a cane crop that yielded from £40 to £50 an acre was more attractive than a yield of £10 an acre from a mixed farm. That reasoning had held good while the sugar industry was in its infancy, but the industry had now reached a stage when the growers produced more than Australia required, and they were obliged to sell the surplus overseas at a price much below the cost of production.

The North had been forced to turn to other avenues of agriculture in the enormous area that remained uncultivated, and this had led to quick development. From the Rise and Shine, O'Connell River, and Eungella lands, in the Mackay district, to the rich lands that lay in the hinterland of Cooktown, there were manifold signs of this more intensive cultivation. Not only was the land being tilled, but there was a ready home market for the produce that it yielded.

For instance, North Queensland for many years had been one of the most prolific fields for the vendors of powdered and condensed milk, which now had been almost wholly replaced by fresh milk from district dairies. Practically the whole of the milk consumed at Mount Isa now was sent under contract by an Ingham dairyman, who dispatched it in pasteurised form in bottles. The same dairyman had orders for three times as much milk as he could supply, and the demand came from places as far distant as New Guinea.

"What is doing more than anything else to settle North Queensland more closely is the provision of more main roads," said Mr. Pease. Despite the abnormally wet season in the North, a fine network of roads was being built to connect lands that were being thrown open to settlers, and when the planned roads were built Queensland would possess one of the longest and best road systems in the world. He could not help

noticing the effect of this improved means of communication in one particular instance—the growth of Mossman, where buildings were being erected, the population had increased, and people on the farm lands were finding an excellent market for their produce in Cairns.

The best proof of development in the North was that in every centre his party visited a deputation had asked for schools in areas where none existed previously. Places which a few years ago were covered by untrodden jungle were now neat, well-developed communities, and this was particularly true of the stretch of land from Townsville to Cooktown.

Although the tobacco industry was not in the most prosperous condition, it had great possibilities, and needed only reorganisation and some adequate form of protection. At the recent sales at Mareeba aromatic leaf brought upwards of 4s. per lb., indicating that a demand for it existed.

"The Government," added Mr. Pease, "was bent on making the most of Northern development. The greater part of the undeveloped Crown lands was situated in that quarter of the State, and offered wonderful scope for adding to Queensland's natural wealth."

Lure of the City.

COMMENTING on the lure of the city, the Public Service Commissioner, Mr. J. D. Story, I.S.O., said in the course of his annual report: "Clearly, it is not possible at present to absorb into vocations peculiar to the towns all those lads who desire employment in such vocations. The growth in the number of applicants who desire employment in clerical and allied positions, and particularly in the various State services, is disconcerting. One views with dread each year the results of the public examinations. Those examinations open the flood-gates and the applications pour in. Parliamentarians, as well as officials, are caught in the vortex. Ten State Service vacancies for male clerks were declared in connection with last Junior examination. There were 580 applicants, and 497 obtained 50 per cent. of marks or over. Ten vacancies were declared for clerk-typists; there were 222 entries, and 201 of the applicants obtained 50 per cent. of marks or over. Approximately 250 senior certificate holders are registered for employment, and there are, in all, not less than 2,000 applicants for employment in the section of the State Service under my jurisdiction. These facts demonstrate the great seriousness of the position.

"The concern is still further intensified by the disinclination of many boys to proceed to positions in the country and the reluctance of their parents to permit them to leave home. The allure of the city grows magically. Entertainers vie with entertainers in providing super attractions. The artificial pleasures of the town are not found in the country; and the routine life of the farm, with its round of chores and ups and downs, lacks the attraction of a great adventure. Cream is not associated with doubloons, nor milk with pieces of eight. Yet the merino fleece, if not the pig, helps to pay the Australian rent.

"The towns depend largely upon the country. If the country stagnates the stagnation will react upon the cities, and the cities will perforce be compelled in their own interests to find ways and means of balancing, in kind, conditions as between city and country. And, the city allure notwithstanding, there are many compensating advantages in the country."

Spraying Experiments for the Control of Fruit Fly in the Stanthorpe District.

By HUBERT JARVIS, Entomologist.

IT is generally recognised that repellents have not yet played an important part in the control of insect pests. This may in some measure be due to a very meagre knowledge of the senses of insects and to the assumption that an odour repellent to a human being would also be repellent to an insect, whereas the reverse might be the case. Furthermore, an odour hardly discernible to man might have considerable value as a repellent or an attractant to the insect community.

Recently serious study has been given by entomologists to this possible avenue of control, and some considerable measure of success has been achieved in South Africa by Dr. Ripley and Mr. Hepburn, who have tested some 350 compounds—essential oils and other substances—for attractant, obscurant, and repellent values in relation to the Natal fruit fly, *Ceratitis rosa* Ksh., which is a serious pest of citrus and other fruits in that country.

During the last few years some time has been devoted in the Stanthorpe district to the study of the possible value of various odours and sprays as a supplementary measure in controlling the Queensland fruit fly *Chætodacus tryoni* Frogg., and during the 1932-33 season it was noticed that the fruit on trees sprayed experimentally with a nicotine sulphate-white oil spray for the control of codling moth was free from fruit fly attack. This spray was accordingly tested as a possible fruit fly repellent during the season just concluded, and the information obtained in the course of the experiment is embodied in this report.

DETAILS OF THE EXPERIMENT.

The plot selected for the work was situated at Severnlea, and comprised two rows of Granny Smith apple trees, there being twenty-eight trees to the row, the sprayed trees being separated by an intermediate row in which the trees were mostly an earlier-maturing variety from which the fruit had already been harvested. The intermediate row was, therefore, not included in the experiment. Twelve trees were left untreated at one end of the plot and four at the other end, thus giving sixteen untreated trees, as controls, and forty sprayed trees. The majority of the trees were very vigorous and full of leafage, and carried a good crop of fruit.

The sprayed trees were given four treatments at approximately weekly intervals (Table I.) with the nicotine sulphate-white oil spray, which was used at a strength of half a pint of nicotine sulphate and half a gallon of white spraying oil to forty gallons of water.

TABLE I.

Time and Cost of Application of Sprays.

Date of Application.	Number of Trees Sprayed.	Materials Used and Strength.	Quantity Spray Fluid in Gallons.	Cost per Application.	Total Cost.	Cost per Tree.
				s. d.	£ s. d.	d.
7th February	40	Nicotine sulphate 1-640 with white oil 1-80	40	6 4½	1 5 6	7·65
12th ,,	40		40	6 4½		
19th ,,	40		40	6 4½		
28th ,,	40		40	6 4½		

The spray was applied with a power plant at a pressure of from 250 to 300 lb., each tree receiving about a gallon of spray fluid per application.

The weather throughout the experiment was favourable for fruit-fly activity, being warm and sultry. Although two of the sprays were applied during fairly hot weather conditions, no damage to the fruit or foliage was observed.

As the fly was active and had caused some loss to the Jonathan apple crop, it was decided to pick the main crop from the control trees, in order to avoid unnecessary loss, and at the time of the first application approximately six cases of fruit remained on the control trees.

Results Obtained.

A week after the first application a few fly-stung apples were found on the control trees, and by the second week over a hundred infested apples were counted. The sprayed trees were also frequently examined, but no fly-stung fruit was found on them until the time of picking the crop, when only thirty-seven fly-stung apples were found in 171 cases graded. The apples were stored in cases in the shed for three weeks, and a final count was made for fruit-fly infestation, the total number of fly-stung fruit from the sprayed trees being 154 apples (Table II.).

TABLE II.

Results of Fruit-Fly Spraying Experiment.

	Total Number of Apples.	Sound.	% Sound.	Unsound.	% Unsound.	Fruit fly-infested.
Treated Trees	17,100	16,946	99·1	154	0·9	154
Untreated Trees ..	607	146	24·1	461	75·9	461

Discussion of Results.

The results obtained indicate that nicotine sulphate and white oil was of definite value in this particular experiment in protecting the apples from fruit-fly attack, the fruit on the sprayed trees being practically 100 per cent. clean, whereas the fruit on the control trees was 75·9 per cent. fly-infested.

In the centre of the intermediate row separating the two experimental rows there were two trees—one Jonathan and one Granny Smith—which carried a considerable quantity of fruit during the course of the experiment, and which were, of course, unsprayed. The Jonathan tree, from which the main crop had been gathered, still carried eighty-one apples, of which number seventy-five were fly-stung—i.e., 92·6 per cent. The Granny Smith tree carried 126 apples, seventy of which were clean and fifty-six fly-stung—i.e., 44·4 per cent. were attacked.

It will thus be seen that the fly was active right in the middle of the plot, and it seems only reasonable to conclude that the spray used acted as a repellent to the fly, as the treated trees were loaded with fruit and only a few feet away from the untreated trees. This conclusion is, moreover, supported by minor experiments conducted with this spray in the Broadwater district.

It is necessary to remind readers that this is merely a preliminary experiment, and that it will obviously be desirable to carry out further trials next season—not only on apples, but also on other fruits—to test the efficiency of the spray and the degree of safety of application. Furthermore, it will be necessary to determine whether there are any cumulative ill-effects arising out of repeated applications of oil sprays on deciduous fruit trees.

ACKNOWLEDGMENTS.

Thanks are due to Mr. E. Cran, who made available the trees for the work, and whose co-operation throughout the experiment was of the greatest assistance. Thanks are also due to the Chief Entomologist, Mr. Robert Veitch, for making possible the work and for his valuable advice and assistance.

A FARMER'S APPRECIATION OF THE JOURNAL.

A Yarwun farmer writes (21*st July*, 1934):—*"I wish to congratulate you most heartily on the excellence of your Journal, for I appreciate to the full the great value it is to the primary producer, almost every phase of farming, fruit culture, and stock-raising being dealt with in simple language, without a lot of unnecessary rigmarole scientific terms, which very often confuse the ordinary producer like myself. Your article in the current month's issue on bread-making in the farm kitchen was, in the wife's opinion, splendid, and despite her forty years' experience of bread-making she found out points that were to her previously unknown."*

Parasites of the Horse.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

THREE species of lice and three species of mites are known to infest the horse, the latter being concerned with mange conditions.

LICE.

Description and Life History.

Of the three species of lice usually found on horses, one species, *Haematopinus asini*, is a sucking louse, the two other species, *Trichodectes pilosus* and *Trichodectes equi*, being biting lice.

The sucking louse (Plate 195, A and B) is yellowish in colour with a brownish thorax and measures about one-eighth of an inch in length. The head is long and narrow, terminating in a blunt point. The eggs laid by the female louse are attached to the hairs and hatch in twelve to fourteen days. The young louse becomes mature and may lay eggs when eleven to twelve days old.

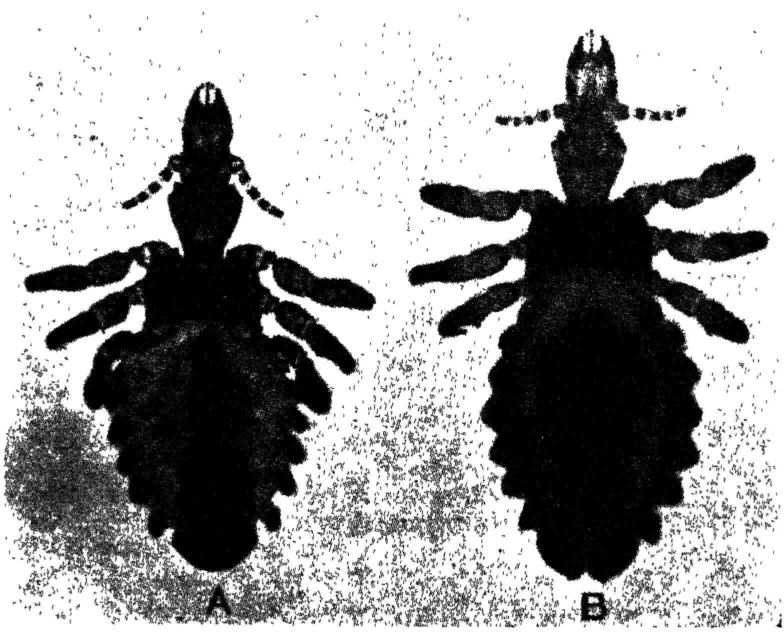


PLATE 195.—SUCKING LOUSE OF THE HORSE (*Hæmatopinus asini*).
A—Male. B—Female.
(Magnified 25 times.)
(From Circular 148, United States Department of Agriculture.)

The two species of biting lice are very similar in appearance, the head being slightly longer than broad and semi-circular in front. *T. pilosus* (Plate 196, A and B) is larger than *T. equi*, with the antennæ placed well back from the anterior margin of the head, whereas in *T. equi* the antennæ are almost on a line with the anterior border.

The general colour of the abdomen in both species is yellow and that of the head, thorax, and legs brownish. The life histories are very similar, the eggs hatching in eight to ten days.

Horses infested with lice may manifest uneasiness and irritation and scratch, rub, and bite the affected portions of the body. Lice most usually occur on the back, flanks, jaws, and butt of the tail, but in heavy infestations the whole body may be involved.

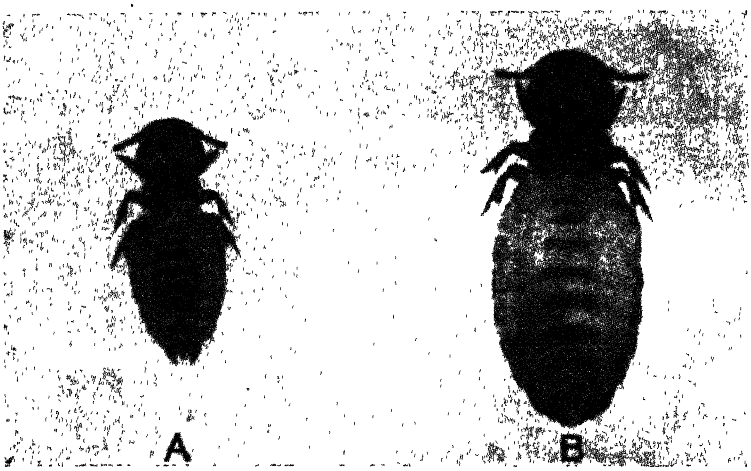


PLATE 196.—BITING LOUSE OF THE HORSE (*Trichodectes pilosus*).
A—Male. B—Female.
(Magnified 25 times.)
(From Circular 148, United States Department of Agriculture.)

Treatment and Control.

Good results follow dipping or spraying in an arsenic dip, two treatments with an interval of fourteen to sixteen days being required. If the infestation is of no great extent the dip solution may be applied as a wash.

Lice are spread mainly by contact. The sucking louse, however, may remain alive off the horse two to three days and the biting lice as long as ten days. Moreover, the eggs may retain their vitality for twenty days when removed from the horse and the young lice that hatch may live a further two to three days. Premises may, therefore, remain infected for twenty-five to thirty days after infested animals have been removed. The stables should, therefore, be thoroughly cleaned out and disinfected. Harness, blankets, curry combs, &c., used on infested horses should be similarly treated.

MANGE.

The three species of mange mites infesting the horse are each concerned with a mange condition which is designated from the generic name of the mite associated with it. Thus we have Sarcoptic, Psoroptic, and Chorioptic mange. Sarcoptic mange is unknown in Queensland and Psoroptic and Chorioptic mange are by no means common.

Sarcoptic Mange.

The mites which cause Sarcoptic mange are known as *Sarcoptes scabiei equi*. These parasites are very minute in size measuring no more

than one-fiftieth of an inch in length. They have a rounded body and four pairs of short thick legs and live in galleries under the skin.

Symptoms of Sarcoptic Mange.

The mites in burrowing under the skin cause great irritation and itching and the skin becomes inflamed and swollen. In time scales and crusts are formed over the affected area and the hair falls out. The animal's biting and scratching at the irritation causes the formation of large thick scabs with which is mingled blood and serum from the broken skin. Eventually the skin becomes thickened and thrown into conspicuous folds.

Usually the head, neck, and shoulders are first attacked, but occasionally the disease may commence on other parts of the body and if unchecked will ultimately affect the whole trunk.

Psoroptic Mange.

This condition is caused by a species of mite, *Psoroptes communis equi*. These mites live on the skin surface, puncturing it with their mouthparts to obtain blood and serum on which they live.

Symptoms of Psoroptic Mange.

Psoroptic mange usually appears first on the head under the forelock, round the roots of the mane and on the rump. The itching and irritation caused by the mites produces inflammation and the formation of papules. Serum exudes from the affected skin and large yellowish crusts are formed. As the disease advances the whole body may become affected and the skin is thickened, toughened and thrown into folds.

Chorioptic Mange.

This disease which is caused by the mite, *Chorioptes equi*, is usually confined to the foot and fetlock. The mite lives on the skin surface and produces a condition somewhat similar to that described for Psoroptic mange. The irritation resulting from infestation causes the horse to stamp and kick, and bite and rub the affected parts.

Treatment and Control of Mange.

For ordinary infestations successful treatments are available and of these dipping, spraying, or washing the affected areas with lime sulphur will be found satisfactory. For sarcoptic mange, treatment should be repeated every five to seven days until a cure is effected. For psoroptic and chorioptic mange the intervals between treatments should be increased to ten days.

To make an efficient lime sulphur solution take 1 lb. of slaked lime and 1½ lb. flowers of sulphur. Add sufficient water to the lime to make a thin paste, then sift in the sulphur stirring and, if necessary, adding water till a mixture of the consistency of mortar is secured. Pour into this mixture about 2 gallons of boiling water and boil until the sulphur disappears from the surface, keeping the mixture well stirred. When the mixture becomes a dark amber or chocolate in colour (about two to three hours) the boiling should be discontinued and the contents allowed to stand till clear. Pour off the clear liquid to which is added sufficient warm water to make 6 gallons. Before using, 7 parts of warm water should be added to every 3 of the prepared concentrate.

Hand applications of crude oil are also recommended as a treatment for mange. Horses so treated should be kept in the shade, as otherwise the oily dressing may blister the skin.

As mange is spread chiefly by contact all affected horses should be isolated till cured. There is also a risk that animals may pick up an infection from stables, &c., in which infested horses have been stalled. Such stables and any harness, curry combs, blankets, &c., should therefore be thoroughly cleansed and disinfected.

INTERNAL PARASITES.

Very few, if any, horses are entirely free from internal parasites, which, with the exception of the bots, are all helminths or worms.

Internal parasites are particularly damaging to young animals, attacking them at a period when they should be making their best growth and rendering them stunted and unthrifty. Among older animals parasite presence is shown by bigger feed bills and the inability of the infested animals to carry out their normal day's work. Stunted growth, emaciation, rough coat, anæmia, swollen abdomen, and sometimes colic and diarrhœa may be associated with an infestation and not infrequently death may follow.

The more important of these parasites are found in the alimentary canal and fortunately most of them are amenable to treatment. Their eggs are present in the manure so sanitation and proper disposal of this infected material is of the utmost importance for parasite control.

BOTFLIES AND BOTS.

There are three species of botflies known to attack the horse, the common botfly, *Gastrophilus intestinalis*, the throat botfly, *Gastrophilus nasalis*, and the nose botfly, *Gastrophilus haemorrhoidalis*.

A B C

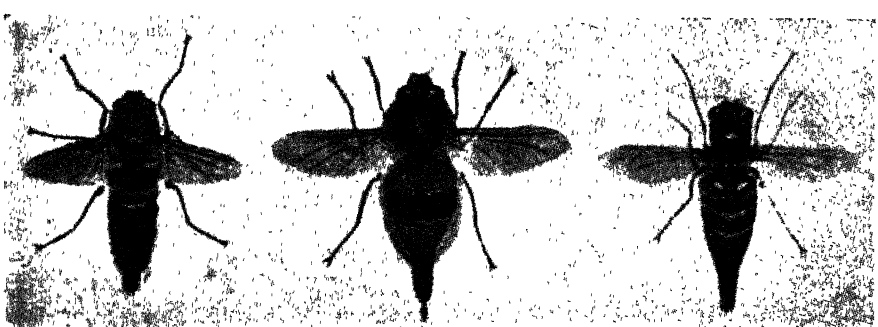


PLATE 197.—ADULT BOTFLIES.

A—The Common Botfly. B—The Throat Botfly. C—The Nose Botfly.

(After Hadwen and Cameron.)

The adults are all two-winged insects, bee-like in appearance, each species differing somewhat in colour markings, size, and habits. The common botfly (Plate 197 (C)) is a brownish-grey species with mottled wings and a white face. The female deposits her eggs on the hairs of the mane, chest, shoulders, and legs, most usually on the long hairs of the forelegs, inside and below the knee. During egg-laying the female hovers around the animal, curving the abdomen beneath the

body in order to facilitate the deposition of the eggs, each of which is laid and fastened to the hair in about a second. The position of the abdomen at the time of egg-laying has given the impression that the fly stings the horse, but this is erroneous.

The throat botfly (Plate 197 (B)) is somewhat smaller than the common botfly and has a reddish thorax and a prominent black band across the abdomen. The wings are clear. The eggs are deposited by the female on the hairs under the jaws. The female fly is usually seen hovering near or between the forelegs of the horse and then quickly darting at the throat to lay her eggs. One to four eggs may be laid at the one time, each attached singly to the hairs. The presence of this fly causes the animal to nod its head violently and sometimes to strike with the forelegs.

The nose botfly (Plate 197 (A)) is the smallest of the species under discussion, and chooses the hairs of the lips for egg-laying, particularly those hairs on the edge of the lip which are moistened by the saliva. The flight of the fly is very rapid, the insect darting at the lips to deposit a single egg and then withdrawing for a few seconds to repeat the process.

Of these three species, the throat botfly is most frequently seen in Queensland. The common botfly is not uncommon but the nose botfly is regarded as being rare, if present at all.

As the mouth parts of the adult flies are rudimentary they cannot feed and are therefore comparatively short-lived. The common botfly has been known to live as long as twenty-one days, but the average life is not thought to extend much beyond a week. The two other species live only about three to twelve days, the throat botfly surviving the longer period.

LIFE HISTORY NOTES.

The Egg.

The eggs of these three botflies are glued to the hairs of the horse and differ considerably in shape, colour, and manner of attachment. The egg of the common botfly is yellowish in colour and is attached to the hair for about one-third of its length, the free portion of the egg forming an angle with the hair. Frequently more than one egg may be attached to a single hair, especially if the hair is long. The eggs do not hatch until they are rubbed or licked by the horse. The minute, spiny maggots are ready to hatch in about seven days, though they may remain unhatched and alive for months.

The eggs of the throat botfly are slightly different in shape to those of the common botfly and are fastened to the hair for about two-thirds of their length. These eggs do not require friction to cause hatching, which takes place normally.

The eggs of the nose botfly are black and stalked, the stalk being corkscrew-like and continued to the follicle from which the hair arises. Here, again, hatching does not require friction; the eggs nearest the moist edges of the lips hatch first, usually in five to six days, while those an inch away may take as long as eighteen days, and those some distance from the lips may not hatch at all.

The Larva or "Bot."

On hatching, the larvae of all species enter the mouth. In the case of the common botfly, of which the life history is best known, the larvae

then bore their way beneath the lining of the mouth and tongue, where they remain for some time. Eventually the larvæ of all three species make their way to the stomach.

Once in the stomach, the larvae attach themselves to the wall by means of a pair of strong mouth hooks (Plate 197). The common bots are reddish in colour and are found attached to the white covering of the left sac and along the ridge between the right and left sacs. The larvae of the throat botfly occur most usually near the pyloric or

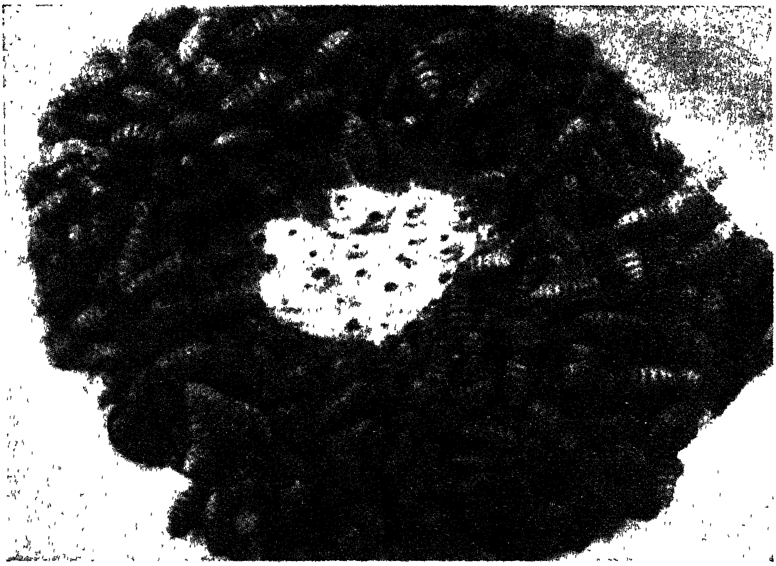


PLATE 198.—"BOTS" ATTACHED TO THE STOMACH WALL, SHOWING LESIONS IN THE CENTRE.
(From Bulletin 957, United States Department of Agriculture.)

exit end of the stomach, and in that portion of the intestine leading out of it. Those of the nose botfly may occur attached to various parts of the stomach, but are more usually located near the pyloric end. The larvae or "bots" are all provided with rows of spines on the anterior border of the majority of the segments, the number and arrangement of the spines differing in each species. After living in the stomach for about eight to twelve months the larvae are fully grown and are passed out with the dung. Those of the common botfly and throat botfly pass out without any reattachment; but in the case of the nose botfly the larvæ fasten themselves to the rectum and again to the anus before they finally reach the ground.

The Pupa.

As soon as they reach the ground the larvæ at once commence to seek some protection. However, they do not crawl very far, and burrow into the soil only a short distance. In one to four days the outer skin hardens and forms a protective coat, known as the puparium, inside which the transformation from the larva or "bot" to the adult fly takes place. The puparium is brown to black in colour, but is otherwise similar to the bot. At the end of about three to ten weeks the transformation is complete, and the adult fly emerges.

Injuries Caused by Botflies.

Possibly the greatest damage among horses through botfly presence is self-inflicted. Extreme annoyance and worry is caused during egg-laying by the females, as the horse recognises its enemy and makes desperate efforts to protect itself. The common botfly appears the least irritating of the three species, probably because of the varied situations in which its eggs are deposited. Even so its presence keeps the animals in a continuous state of annoyance and prevents them from resting. The throat botfly causes the animal to throw its head about violently, and makes it difficult to manage in harness. The nose botfly appears to be the most annoying species, for the insect, in depositing its eggs on the hairs of the lips, causes a severely irritating tickling. The actions of horses while the insects are about are very characteristic. The throat botfly causes them to stand together with their heads over each other's back, and if the nose fly is about they protect their lips by placing them against each other's body. Should the insects be numerous, and the protections abovementioned be inadequate, the animals keep up a continuous movement, occasionally breaking into a gallop, in attempts to prevent the insects alighting and laying eggs.

It is commonly considered that the bots in the stomach are of little importance. It should be remembered, however, that the larvæ are developing for eight to twelve months in the horse's stomach, and during this period considerable harm may be done. The spiny armature and the large mouth hooks cause inflammation of those parts with which they may come into contact, which results in an interference with digestion. Very commonly many hundreds of bots may bring about obstructions and seriously interfere with the passage of food. The nature of the food taken in by bots is not known, but they certainly live at the expense of the horse, and the pinkish hue of some of the larvæ indicates that they may be blood suckers. It has also been shown that their body fluid is decidedly toxic, and if a small quantity of this fluid is injected beneath the skin alarming symptoms may result.

Protection and Treatment.

Various devices have been recommended for the protection of the horse against botfly attack. For the throat botfly a piece of ordinary

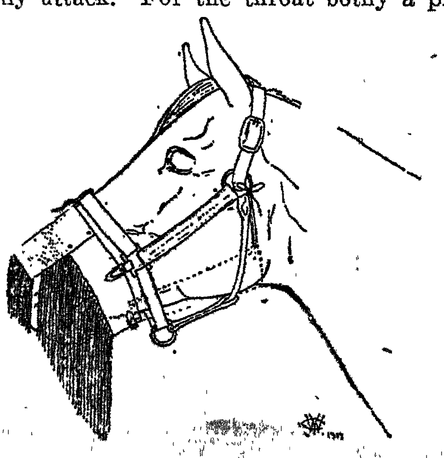


PLATE 199.—LEATHER NOSE-FRINGE AS PROTECTION AGAINST THE NOSE BOTFLY (after Hadwen and Cameron).

canvas attached to the nose band and tied to the headstall will completely cover the region between the jaws. As protection against the nose botfly the Canadian authorities recommend a leather band cut into thin strips and encircling the nose (Plate 199). In the United States excellent results have followed the use of a mouth guard constructed from ½-inch hardwood boards. For protection against the throat and nose flies it is recommended that the throat be covered by a piece of canvas which is attached in front to the wooden mouth protector (Plate 200). Furthermore, this combination device is said to prevent the animal from taking into the mouth the larvæ of the common botfly while attempting to bite or scratch itself. The hardwood guard completely protects the lips when the head is up, and the block beneath causes the guard to fall back when the head is lowered, and does not interfere in any way with the animal's grazing.

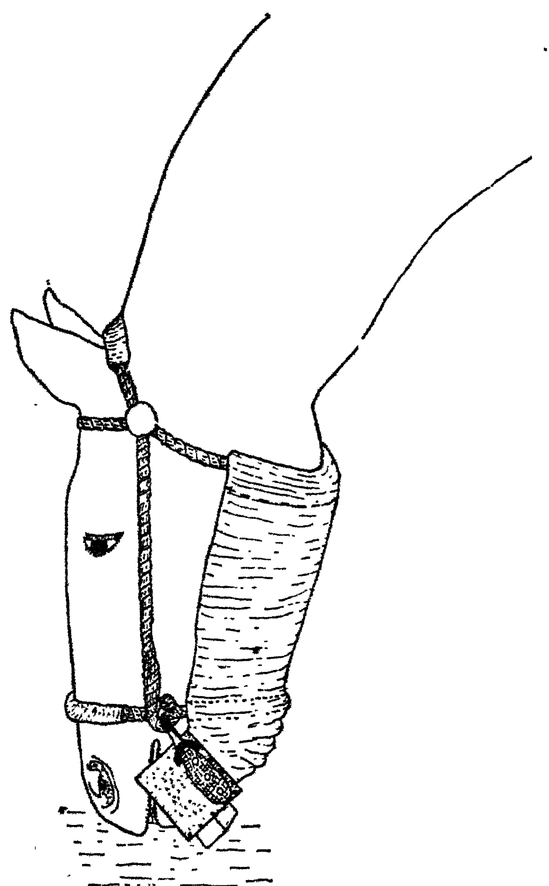


PLATE 200.—DEVICE FOR PROTECTION AGAINST THE THROAT AND NOSE BOTFLIES (after Bishopp and Dove).

Another effective protector for use against the nose botfly when the horse is in harness consists of a piece of leather 4 to 6 inches wide attached at each side to the bit ring so that the entire lips are covered.

As the eggs of the common bot are not confined to any particular region of the horse, it is difficult to recommend any good means of protection. The mouth guard mentioned (Plate 200) will be found beneficial. In other parts of the world the provision of deep sheds or brush shelters is said to give some protection, for when the flies are bad the animals may retire into the sheds, into the shady interior of which the flies will not venture.

Frequent grooming and clipping of the hairs of the areas on which eggs are laid will aid in control, and a 2 per cent. carbolic wash applied with a rag will kill the majority of the eggs.

For the removal of the bots carbon bisulphide will be found very efficient. The animal should be fasted for eighteen to twenty-four hours before treatment, and the drug is given in a capsule, the dose rate being 6 cubic centimetres for every 250 lb. weight, horses of 1,000 lb. weight or more therefore requiring a dose of 24 cubic centimetres. The capsule may be administered either by hand or with a balling gun. No food or water should be given for three hours after treatment. No purgative is required either with or following the drug. If there is any question as to the animal's ability to tolerate this dose, divided doses may be given and treatment suspended if ill-effect follows the administration of a partial treatment. Great care should be taken in the administration of the capsule, for if it should break and the drug enter the lungs fatal results may follow.

It is also advisable to wash the animal thoroughly with the 2 per cent. carbolic solution before treatment to destroy any eggs, otherwise the young bots hatching from the eggs will be taken in and reinfest the stomach.

TAPEWORMS (Anoplocephala spp.).

Three species of tapeworms are known to infest the horse, the largest and smallest of which, *Anoplocephala magna* (Plate 201) and *Anoplocephala mammillana* respectively, are found in the small intestine. The third species, *Anoplocephala perfoliata*, occurs in the large intestine, particularly in the blind gut or cæcum.

Plate 201.—The Large Tapeworm of the Horse (*Anoplocephala magna*). (Natural size.)

Unless present in large numbers tapeworms do not appear to cause any serious ill-effects, but a heavy infestation might cause emaciation

and anæmia. *A. perfoliata* is the most harmful species, and produces ulcer-like lesions on the intestine wall. Their life histories are unknown.

Tapeworm infestation may be readily diagnosed by examining the fæces in which segments of the worms may be found. Blood-stained fæces is often indicative of the presence of *A. perfoliata.*

Treatment and Control.

Turpentine is said to be satisfactory if given in a dose of 2 fluid ounces in capsules after thirty-six hours starvation, followed every second day by 1 ounce in capsule until five or six doses have been given. The last dose should be preceded or followed by 1½ pints of raw linseed oil. This treatment is for a 1,000-lb. horse, and the dosages should be reduced accordingly for lighter and younger animals.

Tartar emetic is also considered effective in two doses of 3 drachms each at an interval of twelve hours. The drug should be mixed with a gruel of linseed meal.

As the life histories of the horse tapeworms are unknown, general control measures only can be recommended, and of these sanitation is the most important.

THE LARGE STOMACH WORMS (Habronema spp.).

Three species of large stomach worms, *Habronema spp.*, occur in the stomach—namely, *H. megastoma*, *H. muscæ*, and *H. microstoma*. Both *H. muscæ* and *H. microstoma* may grow up to an inch in length, and occur free or attached to the stomach wall. *H. megastoma*, on the other hand, rarely exceeds half an inch in length, and is found in nodules of varying sizes in the stomach wall itself.

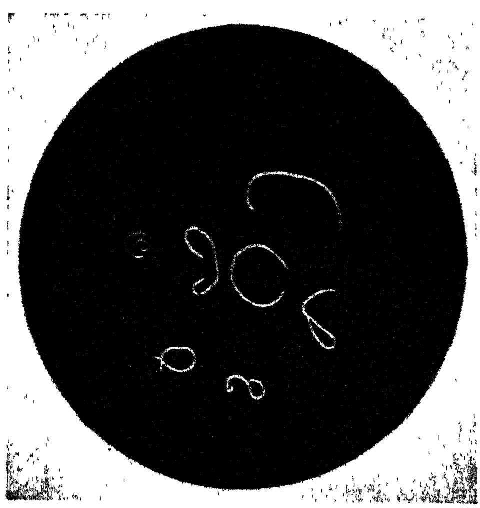


PLATE 202.—LARGE STOMACH WORM (*Habronema* spp.).
(Natural size.)

Life History.

The eggs laid by the female worms eventually reach the exterior in the dung. They must then be swallowed by the maggots of certain

species of flies which breed in horse dung. The larvæ which are developing in those maggots are still present in the adult flies when they emerge. In the adult fly they congregate in the region of the proboscis, and when the fly is attracted to the horse's mouth by the moisture there they break out of the proboscis and, reaching the mouth, are swallowed. They eventually reach the stomach, where they settle down and grow to the adult stage. Infection may also occur when live or dead flies are swallowed.

The house fly, *Musca domestica,* is of great importance around stables as the intermediate host of *H. muscæ* and *H. megastoma,* whilst in the bush its place is taken chiefly by the bush fly, *M. vetustissima,* which closely resembles the house fly in general appearance.

The stable fly, *Stomoxys calcitrans,* forms the intermediary of infection for *H. microstoma,* the larvæ in its proboscis, rather peculiarly, preventing the fly from using the proboscis as a piercing organ and compelling it to take its food by suction only. The insect is therefore no longer able to obtain blood, and to exist must attempt to live on the moisture round the horse's mouth and eyes, &c.

Effect on the Horse.

Habronemiasis, which is the name given to the disease condition caused by infestation with these three species of worms, is a very important disease in Australia, as it is considered that a large percentage of debility cases among horses is due to this cause.

Habronema muscæ and *Habronema microstoma* irritate the stomach lining, and may cause serious digestive disturbances. *H. megastoma* is the most harmful of the three species, for it burrows into the stomach wall, destroys the gastric glands, and causes the formation of fibrous nodules. Occasionally these nodules may be so numerous and so large as to interfere very seriously with the passage of food.

These roundworms may also be concerned with certain types of skin growths. These are caused by the larvæ breaking out from the proboscis of the fly when it is feeding on sores or moist places, such as the eye, and burrowing into the skin and tissues. In Australia growths in the eye and on the penis have been shown to be caused by these larvæ, and swamp cancer may also be an associated condition. In other countries "summer sores" are a direct result of larval infestation of the skin.

Treatment and Control.

Owing to its location in nodules in the stomach there is no effective treatment known for *H. megastoma.* The removal of *H. muscæ* and *H. microstoma* may be effected if the horse is previously starved for eighteen to twenty-four hours, and the stomach washed out with 8 to 10 quarts of 2 per cent. sodium bicarbonate. This should then be siphoned off. When syphoning is not carried out fifteen to twenty minutes should be allowed to elapse. Carbon bisulphide is then given at the rate of 6 cubic centimetres for every 250 lb. weight with a maximum dose of 24 cubic centimetres. No food or water should be given for another four hours.

Control is only possible so long as the manure is regularly collected and so disposed that the intermediate fly hosts are unable to breed in it. Spraying and trapping flies among stabled horses is also desirable.

General measures for a high standard of sanitation must not be overlooked. Efficient methods of manure disposal will be discussed in detail later.

Where horses are running on large pastures it is difficult to suggest any control methods that are practicable, but for obviously affected animals periodical treatment is advised.

THE SMALL STOMACH WORM (Trichostrongylus axei).

This is a small slender species, no more than about one-fifth of an inch in length, which occurs in the lining of the stomach. It has only recently been recorded from the horse in Australia, and its importance in this country is unknown.

In other countries where this parasite is present it is said to injure the stomach wall, causing lesions somewhat like ringworm in appearance. The life history is not definitely known, but is direct—that is, no intermediate host is required.

The treatment recommended for the large stomach worms is also advised for this species.

THE LARGE ROUNDWORM (Ascaris equorum).

These are very conspicuous worms, yellowish white in colour, and attaining about 12 inches in length. At the anterior end is the head bearing three distinct lips and marked off from the rest of the body by a constriction. The large round worm occurs in the first portion of the small intestine, and frequently in very large numbers, especially in young horses.

Life History.

The eggs laid by the female worms reach the exterior in the dung. Under favourable conditions of temperature and moisture a tiny embyro appears inside the egg in about fourteen days, and in this stage the egg is ready to infect other horses. When swallowed by the horse the egg hatches in the intestine, and the tiny larva that is set free immediately bores into the intestine wall, reaches the blood vessels, and is carried to the liver. From the liver it is eventually taken to the lungs in the blood stream. After a certain period of development in the lungs the larva then migrates into the trachea or windpipe, crawls up into the mouth, is swallowed, and reaches the small intestine again, where it may settle down and grow to the adult stage.

Effect on the Horse.

The large roundworm is especially harmful to young horses, and heavy infestations result in an unthrifty and stunted condition. The migrating larvæ damage the liver and lung tissue, and may cause fever and lung disorders. The adult worms, when in numbers, produce serious digestive troubles, and sometimes the worms, in bunching together, hinder the free passage of food, and symptoms of colic may be evident. The toxins or poisonous substances produced by both larvæ and adults may also be a cause of illness. Frequently infestation may be diagnosed by watching the dung in which the very conspicuous adult worms may be passed.

Treatment and Control.

Carbon bisulphide as recommended for bots is also a highly efficient drug for the removal of the large roundworm.

Turpentine may also be used, but is not so effective. The animal to be treated is starved for eighteen to twenty-four hours. For an animal weighing 1,000 lb., 2 ounces of turpentine are administered, followed by an aloes ball or 1½ to 2 pints of raw linseed oil. Both the turpentine and linseed oil should be as pure as possible.

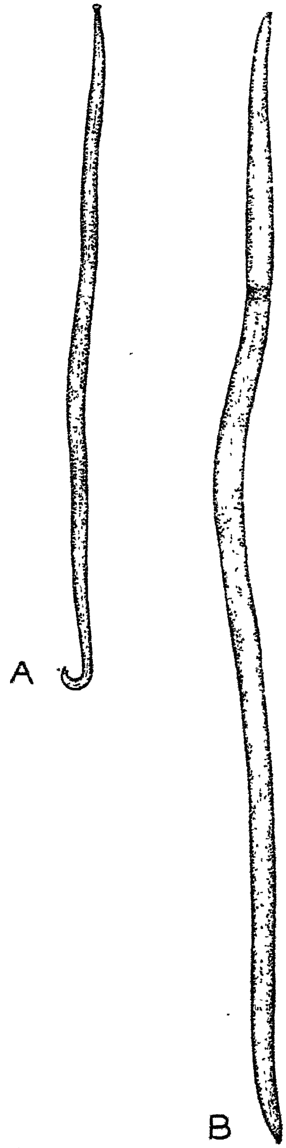


Plate 203.—The Large Roundworm (*Ascaris equorum*).
A—Male. B—Female.
(About half natural size.)

Control is possible only with strict sanitation. Treatment will remove the adults from the intestine, but has no effect upon the larvæ in the liver and lungs. The egg stage, moreover, is highly resistant to adverse conditions, and can exist for long periods in suitable places.

Removal of manure, drainage, &c., are necessary factors for the control of this parasite. Special paddocks should be reserved for the mother and foal, either new land or such as has not been used by horses for at least a year.

PALISADE WORMS (Strongylus spp.).

These worms are also known as blood worms or red worms, owing to their red colour, which is due to ingested blood. There are three species present in the horse—*Strongylus equinus,* which is the largest and may grow up to 2 inches in length; *Strongylus edentatus,* which attains a length of 1¼ inches; and *Strongylus vulgaris,* which is rarely more than about 1 inch in length. All these species occur firmly attached to the walls of the large bowel and blind gut.

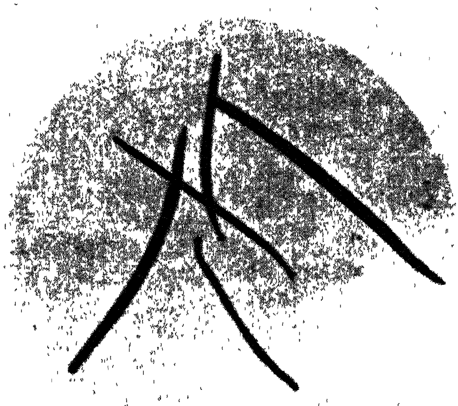


PLATE 204.—PALISADE WORMS (*Strongylus* spp.). (Natural size.)

Life History.

The eggs reaching the exterior in the manure hatch in a day or two. The tiny larva that emerges undergoes certain development, and in about a week reaches the infective stage. These infective larvæ are enclosed in a sheath which assists them to resist unfavourable conditions for long periods. They then migrate up the grass blades and are swallowed by the horse when grazing. Their life cycle in the horse is not definitely known, but it is considered to involve a movement through various organs, the liver and lungs especially, as in the case of the larvæ of the large round worm. They eventually return to the large gut, attach themselves to its wall, and grow to maturity.

Effect on the Horse.

Palisade worms injure the gut wall and live on blood. During their life cycle in the horse extensive damage to the liver and other organs, into which the larvæ may wander, may occur. Heavy infestations cause anaemia, diarrhœa, weakness, and emaciation. They have a big effect on working horses, so lowering their vitality that the horses do less and less work as the disease occasioned by the infestation advances.

Strongylus vulgaris is especially dangerous, as its larvæ invade the walls of certain arteries, especially those supplying the large bowel with blood. As a result of this invasion the walls of the artery thicken, harden, and enlarge, to form a conspicuous dilation known as an aneurism. This interferes with the circulation of blood, and as a result the large intestine does not receive an adequate supply. Sometimes complete blockages occur in these arteries. Anæmia, emaciation, and colicy conditions may arise. Occasionally portions of the aneurism may be carried into blood vessels in other parts of the body. The vessel becomes blocked by this material, and sometimes serious and fatal hæmorrhages may occur. If any of the main vessels supplying the limbs become plugged lameness may result.

Treatment and Control.

Oil of chenopodium is considered to be a highly satisfactory drug for the removal of palisade worms. This drug is given after thirty-six hours' starvation, preceded or accompanied by raw linseed oil or an aloes ball. The dose for animals two years and older is 4 to 5 fluid drachms of chenopodium with 1½ to 2 pints of raw linseed oil. Young horses six months old and over should be given 1 drachm of the drug.

For pregnant mares carbontetrachloride in doses of 6 to 12 fluid drachms is advised.

Stable sanitation is necessary for the control of the palisade worms. Low-lying paddocks of a marshy nature should be avoided as horse pastures.

SMALL STRONGYLES.

The large bowel and blind gut are also infested by small whitish and reddish worms measuring usually about ½ inch to 1 inch in length, and sometimes occurring in enormous numbers. Some of these produce

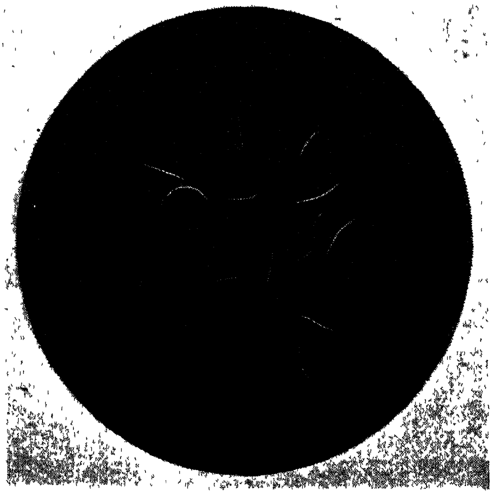


PLATE 205.—SMALL STRONGYLES. (Natural size.)

nodules in the gut wall, in which they spend the early portion of their parasitic life. The horse becomes infested when it swallows infective larvæ which are present in the soil and on the grass.

The small Strongyles contribute to the effects of gross parasitism, and assist in causing diarrhœa, weakness, anæmia, and emaciation.

Treatment and control is on the same general lines as that advised for palisade worms.

PIN WORMS (Oxyuris equi).

The female pin worm is whitish with a long pointed tail, measuring from 2 to about 6 inches in length. The male is smaller, and is seldom seen. This species infests the large bowel.

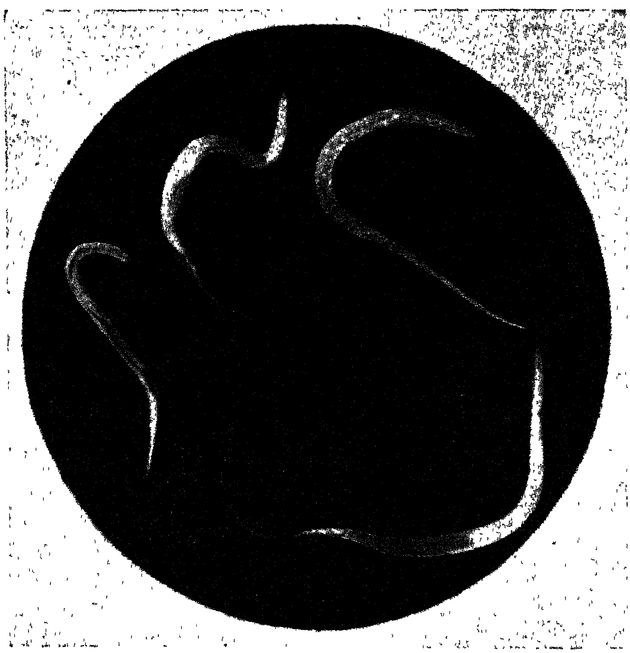


Plate 206.—The Pin Worm of the Horse (*Oxyuris equi*). (Natural size.) (From Circular 401, University of Illinois.)

Life History.

Instead of laying eggs which may reach the exterior in the manure, the gravid female worm itself passes out in the manure, and then deposits eggs. Sometimes these females adhere around the anus, depositing their eggs in this situation, the masses of eggs having the appearance of yellow crusts. The eggs eventually become infective, and when swallowed by the horse hatch to give rise to tiny larvæ. These larvæ make their way to the large bowel, where they grow to maturity.

Effect on the Horse.

Pin worm infestation may be responsible for digestive disturbances. The clustering of the female worms around the anus causes severe irritation, which the horse attempts to relieve by rubbing or scratching.

Treatment and Control.

Turpentine or oil of chenopodium as advised for the large round-worm and palisade worms respectively is said to be satisfactory for the

removal of pin worms. A high standard of sanitation is necessary if infestations are to be controlled.

GENERAL CONTROL MEASURES.

Manure Disposal.

(*a*) The regular collection and proper disposal of all manure is an extremely important measure for the control of the worm parasites of horses.

All manure should be collected daily. It may be used for fertilizing purposes only on pastures to which horses are not admitted. In such cases it should be well scattered over the ground. This enables it to dry out quickly, and renders it unsuitable for breeding purposes by the house fly and other species.

Otherwise the manure should be stored in compact heaps, well beaten down on the top and on the sides with a shovel. The heat generated in such closely compact heaps kills any fly maggots and a big percentage of the worm eggs. To make the heap as safe as possible the outer few inches should be buried into the heap every week or so.

(*b*) The three species of stomach worms are all carried by flies which breed in manure. Fly traps should be provided in various parts of the premises. A good spray may be made by extracting ½ lb. of fresh pyrethrum in 1 gallon of kerosene for two hours.

(*c*) Good drainage and dry conditions are important both in the stables and in the pasture.

(*d*) Stable bedding should be changed frequently, and the stables should be kept as clean as possible.

(*e*) Do not allow the food to become contaminated with manure by throwing it on the ground. Place the food in well-constructed feed-boxes raised well above the ground surface. Good, clean water should be provided.

(*f*) Do not overstock on pastures, and if possible use the horse paddock for yearly periods for cattle or sheep.

(*g*) Young horses are most readily affected by parasites, and any control measures should be especially enforced where they are concerned.

By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

Part III.

THE BERKSHIRE.

As the most adaptable of several dual-purpose types, the Berkshire occupies a prominent place in the list of breeds approved for use in this country in the production of pork and bacon pigs for both the domestic and export markets.

Introduced away back in the very early days of Australian settlement, and maintained as a pure breed by careful breeding and regular importations of fresh and unrelated blood, the Berkshire is distributed throughout the Commonwealth and New Zealand.

The first imported boar listed in the herd books of the Australian Stud Pig Breeders' Society (formerly the Berkshire and Yorkshire Society of Australasia) is "Burton Harold" (imp.), who had as his sire, "Blenheim," BB5792 and dam, "Stumpy," MDXXVII., BB6841. This boar was the grand sire on the dam's side of "Dan No. 1," the first boar to be registered. "Burton Harold" (imp. was the sire of "Violet 2nd," owned by Mr. George Madden, a veteran enthusiast in the showrings of Victoria. "Dan No. 1," was owned by Mr. T. K. Adkins, so was "Silky No. 2," the first female Berkshire registered here. Of course, Berkshires were available in pure bred form for many years prior to the establishment of a Stud Society or a stud pig herd book.

It is recorded that the Berkshire was the pig that brought repute to British pigs abroad when distribution to other countries became possible. The breed has a long and distinguished history and has earned a high reputation among butchers and curers for its evenness of lean and fat, and absence of waste. They are quick growers on a minimum ration, and with careful handling and judicious feeding can be satisfactorily finished for market, either as light or medium weight porkers or for heavier weights in pork and bacon grades.

Their original home was in West Berkshire, England. Their colour was black with splashes of white over the body. Some early records refer to the colour as brownish red; in fact, even to the present day where breeding is neglected, there is a tendency to revert to this brownish

tinge in the hair. Trade was fairly brisk, and there are records of exports of Berkshires to the United States and Canada in the year 1864. In July, 1883, R. Swanwick, A. Stewart, and H. Humphrey convened the first meeting of interested breeders at Berkeley, which led to the formation of the British Berkhire Society in 1883. R. Swanwick was the first president and H. Humphrey the first secretary. This Society prospered, and regularly issued herd books, and continued on until 1927, when it amalgamated with the National Pig Breeders' Association of England. Mr. Arthur Beale was the secretary of the Berkshire and Yorkshire Society in Australia when registration was first introduced here.

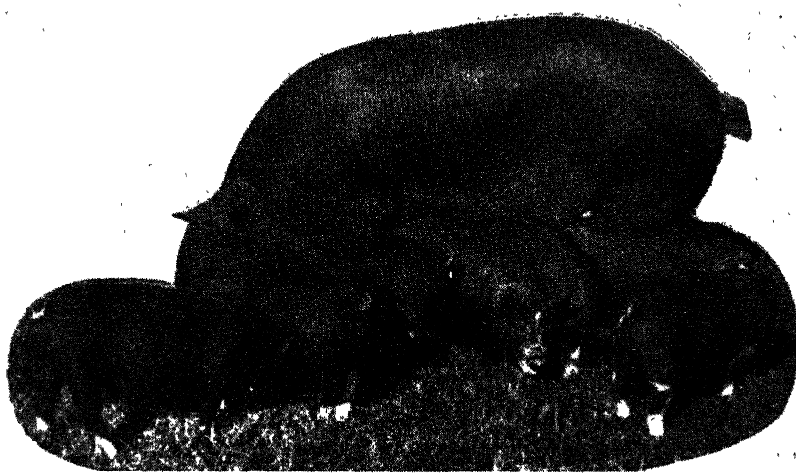


PLATE 207.

Champion Berkshire Sow, with first prize litter at foot, Brisbane Exhibition 1934, "Linton Patience," imported by Mr. Frank Bach, of Oakey; a sow of excellent type and conformation.

Australian experience with the Berkshire breed confirms its overseas reputation, where the breed's claim as a producer of highest quality of pork and bacon has been proved by its repeated successes for over thirty years in show competitions of live and dressed meat, and especially as light-weight porkers. Its usefulness for crossing with larger and slower maturing breeds proved there has been borne out here, the Tamworth-Berkshire cross being a typical instance. This particular cross has for many years been the most popular of all bacon pig crosses in Australia, and even in face of competition of the Large White and its crosses, the Tamworth-Berkshire cross holds its own, although white skinned pigs are preferred for export requirements. That Berkshires are capable of producing heavy weight carcasses, if desirable, was shown in 1929, when a pair of Berkshire crossbreds scaled 6 cwt. 3 qr. 23 lb. when seven months old, an average daily gain of 1·77 lb. The supreme championship carcass at the same British livestock show was a purebred Berkshire scaling 140 lb. live weight at five and three-quarter months. There is abundant evidence in results of Smithfield carcass contests and numerous other shows in England and elsewhere where carcass contests are staged, to prove that the Berkshire can always hold its own in the keenest of competition. The same holds good in Australia.

Record Sale Prices.

Some remarkable sales were recorded from 1919 to 1923, a period of world wide high prices for stud stock. The Duke of Westminster auctioned sixty-two head of pure bred Berkshires averaging £115, the top price being 610 guineas, also 500 guineas for another at the same sale. Other high prices realised were 400, 370, 360, 310, 210 guineas, with others at prices from 200 guineas downwards. Such prices of course have never been realised in Australia, although, in comparison, Berkshires have always fared well at show sales if the quality and type is there to pay good dividends. Perhaps the record price for a Berkshire boar was that obtained for "Pamber Ugly Duckling," farrowed in 1920, and a Royal championship winner. He was noted as the record priced boar of any breed, and sold for 700 guineas for export. "Highfields Royal Pygmalion," farrowed in 1921, bred by F. Townend, a supreme

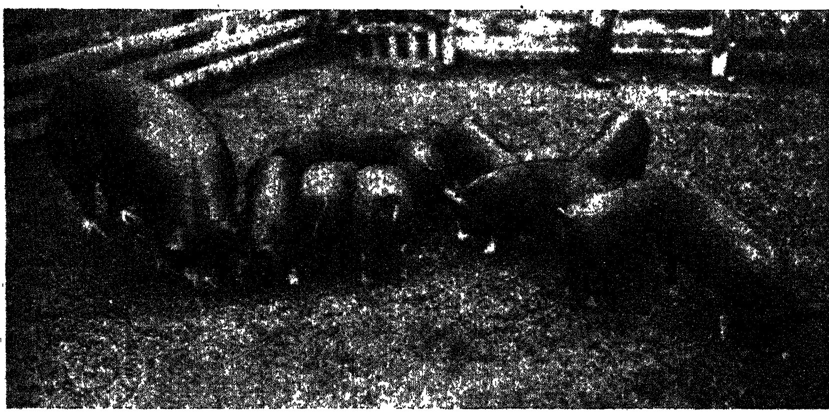


PLATE 208.

"Gatton Dell" and litter; an excellent group, representative of the very best there is in Berkshires in this country. Note evenness of conformation, well developed hindquarters and typical breed markings.

Royal champion in 1922, and sold for £500 to the Eaton stud. It would be interesting to have records of high-priced Berkshires in Australia. Mr. Edgar Humphrey, from whose article in the Jubilee issue of the Pig Breeders' Annual much of this information has been extracted, is of opinion, after a life time's experience with this breed, that it can be said with confidence that the Berkshire is as good to-day as ever it was, and can be regarded as an ideal breed for the production of light weight porkers so popular in the Old Country. The cross with the Middle White is even a better pig for this purpose, to my way of thinking, for the white-skinned progeny of this cross certainly do appeal and are most attractive, although care must be taken to avoid over-fattening.

Points of the Berkshire.

In colour, the Berkshire is black with white points, a white star or splash on the face, four white feet, and a white flag or brush on the tail, all desirable markings referred to by Mr. Humphrey as the hallmark of purity, a proof of over sixty years' pedigree breeding for improvement in quality of meat production. It has been a moot point for some years in Australia as to whether there is any difference between the

Berkshire and the Improved Berkshire, so called a few years ago when a better, more attractive, and more dished-face type of Berkshire was imported. In my opinion, there is no difference in Berkshires in these days, that is, pure bred Berkshires are all of an improved type. It is well to remember, however, that in Australia we have a type once called Improved Berkshire which differs in type and general conformation to that we now refer to as the English type; the latter being the latest production in the breed and the most popular abroad. Our illustrations show some variation, especially in formation of hind quarters and face. Objectionable features in Berkshires are few, but important.

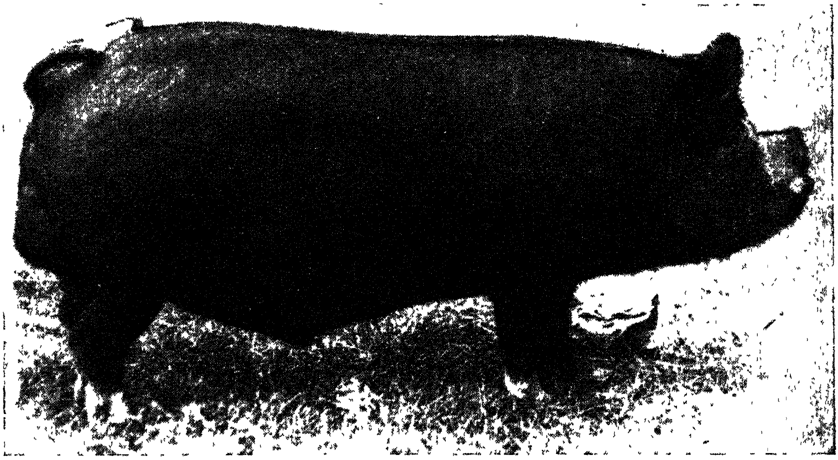


Plate 209.

"Goodna Model," stud sire at the Farm Home for Boys, Westbrook, and sire of first prize litter, shown with Champion sow "Linton Patience" (imp.).

There is a tendency to mismarking in many of the pigs of to-day; this practically covers all strains within the breed, and it is fairly safe to say it is difficult indeed to obtain a family of Berkshires that will produce 100 per cent. of well-marked pigs. Possibly our herd book standards are too severe and, perhaps, we should admit that many of our best-bodied Berkshires are faulty in markings. However, there appears to be a general acceptance of the position, and the result is that practically all champions in these days conform to herd book colour standards.

The boars are active and reliable workers if kept in reasonable breeding condition. The sows are good milkers and good sucklers; over-fattening and a lethargic condition are distinctly detrimental to breeding qualities and should be guarded against. It is certain that this breed will rise or fall in importance in accordance with its ability to breed freely, regularly, and abundantly. Any animal not capable of reproducing its species in a profitable way should be rigorously culled, and replaced by a more profitable animal. Many animals are ruined by over-fattening for show purposes; they do not only suffer in so far as their breeding organs are concerned, but they become knock-kneed, cow-hocked, and go down in the pasterns. One occasionally sees Berkshire sows (in particular) with a protruding tongue, an overgrown organ which they cannot control because it is too long to comfortably fit in the mouth.

This is a very bad fault. One notices some Berkshire boars and sows with such heavy drooping eyelids that the animals are virtually blind; they certainly have no full use of their eyes when in this condition, although the sense of smell is extra keen, and the animal may go for many months before being noticed. There is a tendency where breeding is neglected for the colour to fade to a brownish tinge on very coarse hair; this also should be guarded against. Sows that are clumsy and unable to satisfactorily rear a litter with a minimum of eight should also be disposed of,

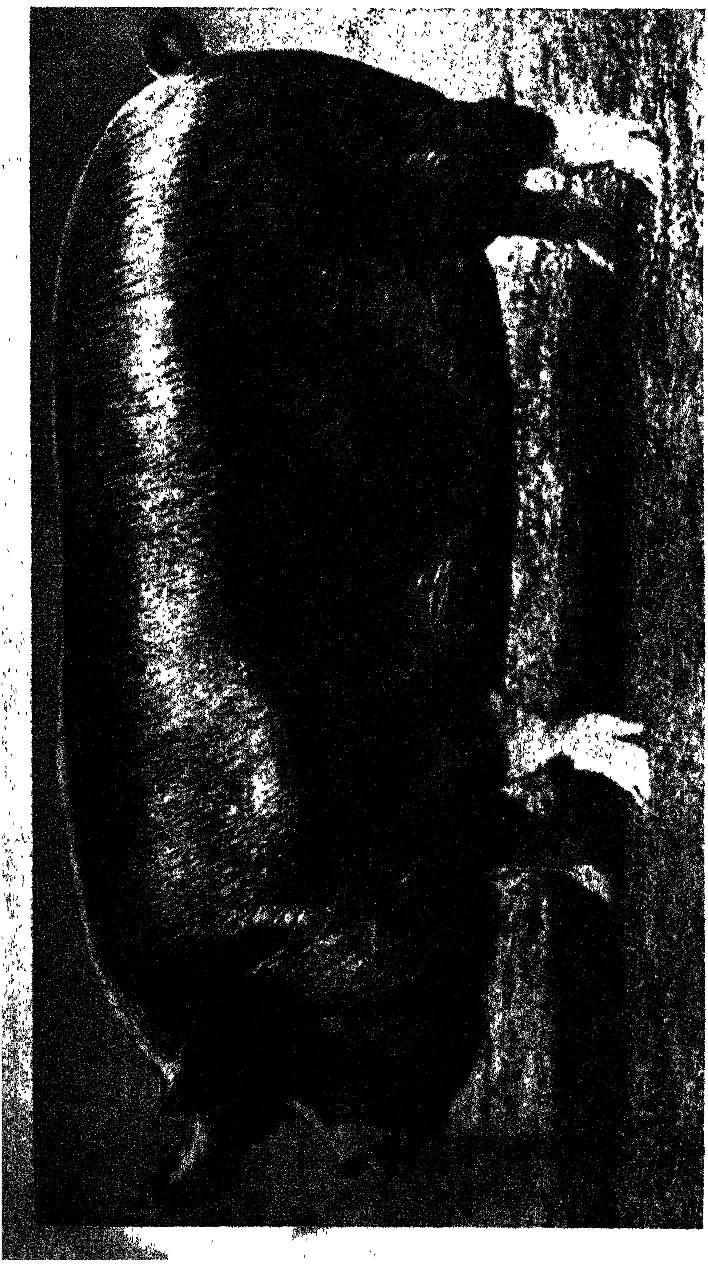


PLATE 210.

Berkshire sow of the most approved British type, "Basildon Princess Royal," supreme champion at the Royal Agricultural Society's Show, Harrowgate, England, a sow spoken of by overseas authorities as thoroughly typical of the best there is in Berkshires. Note her compact, yet roomy frame, her long deep body, and attractive appearance. The Berkshire is the most popular breed of pig in Australia, and has a wide distribution throughout the world, particularly in English-speaking countries.

for no breeding sow is profitable unless she rears eight or more well-developed pigs per litter; and there should be two litters per annum between the age of one and six years.

Prominent breeders of stud Berkshires in Queensland include the Government institutions at Gatton College, Goodna, and Willowburn Hospitals; Farm Home for Boys, Westbrook; H. Franke; M. Porter and Sons; F. Back; J. W. Handley; J. Barkle; O. L. Klein; Wide Bay Stud Piggery; Kairi State Farm and many others.

STANDARD OF EXCELLENCE FOR BERKSHIRES.

	Points.
Head and Ears.—Moderately short; face dished; snout broad and wide between eyes; ears fairly large, carried erect or slightly inclined forward, and fringed with fine hair	15
Neck and Shoulders.—Medium length, evenly set on shoulders; jowl full, but not heavy; shoulders fine, sloping backward, and free from coarseness	10
Back and Sides.—Back long and straight; loin full; ribs well sprung; sides full and deep to flank; showing straight underline; and in sows, twelve good, evenly placed teats	20
Hams.—Wide and deep to hocks tail set high on back line, and fairly large ..	20
Legs and Feet.—Legs short, straight and strong; feet set wide in line with shoulders; hoofs nearly erect	15
Colour, Skin, and Hair.—Black, with white on face, feet, and tip of tail; skin fine and free from wrinkles; hair long, fine, and plentiful	10
Character.—A combination of all points showing distinctive breeding, type, and quality	10
	100

IMPORTANCE OF COOLING CREAM.

The first step towards controlling the action of bacteria in milk and cream is to prevent such organisms as have gained access to these products from multiplying to sufficient numbers to cause trouble. The only way to do this is to cool the milk or cream as much and as soon as possible. In the absence of water being laid on to the separating room, any of the small water-bag coolers, to cool the cream straight from the separator or the milk immediately it is drawn, are very efficacious, as every degree of temperature we bring the product below 80 degrees Fahr. will have a retarding effect on the bacterial development, and in many cases (in relation to weed taints, &c.) the aeration will improve the flavour.

If a cooler is not available a lot can be done by standing the milk or cream cans in cold water, or putting wet bags round them, but it must always be remembered that fresh water is advisable each day, and the bags should be changed each day and allowed to dry. In the case of cream it should be stirred with a tinned metal stirrer two or three times each day, and not be mixed until each lot of cream is cool. Finally, it should be delivered to the factory daily, if possible.

With reference to the delivery of cream, many producers, after taking as much care as possible on the farm, allow the product to become heated in transit to the factory, either by not having a well-shaded stand or, when they do the carting themselves, by not taking the trouble to keep the cans covered (by, say, clean wet bags). This neglect may very often be fatal to quality.

Marketing Table Poultry.

By P. RUMBALL, Poultry Expert.

IN the ordinary commercial sense, table poultry is not produced to any appreciable extent in Queensland. Although this branch of the poultry industry has not yet been developed in this State, there is no reason why it should not receive serious consideration by those who may be in position to enter into what is really a specialised business.

The basis of the poultry industry in Queensland is egg production, for which breeds such as Leghorns and Australorps are bred, the former predominating. Under these conditions the class of bird which forms the bulk of poultry sold for table purposes are young cockerels of both light and heavy breeds and hens culled on account of their age, or for other reasons which have rendered them unprofitable as egg producers.

In marketing there are two distinct conditions to be considered, namely:—(*a*) Conditions which are entirely in the hands of the individual producer; and (*b*) conditions under which the birds are sold. The latter conditions, by reason of the fact that they apply to all producers selling poultry, and the fact that they do not come under the immediate control of the individual producer, are possibly the more important and therefore can take precedence.

Present System of Sale.

Although large numbers of birds are sold privately, the greater number reach the consumer through the auction markets. A conservative estimate of the value of poultry sold daily in the metropolitan area would be in the vicinity of £250. This, to some, may appear rather a high estimate, but an inspection of the markets will convince the observant person that the estimate is, if anything, on the low side.

The birds are received by the selling agents by rail or direct from the producer in crates of all types, shapes, and sizes. They are then dumped on the saleroom floor, little effort being made by either the producer or agent in the direction of classification, and sold to the highest bidder.

Undoubtedly at times, even under these conditions, the birds tendered for sale realise payable prices, but, again, at other periods they are sold considerably under their value. The low values are, no doubt, influenced by the supply and demand, but at the same time, if the birds were classified, displayed to advantage, and put up for auction in numbers which would permit of the general householder bidding, values would be materially increased.

Transport of Poultry.

The conditions under which table poultry are sold undoubtedly leave room for improvement, both from a humane and a commercial point of view. From the humane point of view the crates used for forwarding birds to market should have sufficient head room and floor space for the number and variety consigned. They should be well ventilated and provided with water receptacles, the latter being firmly attached to each corner of the crate. The crates for fowls and ducks should be at least 18 inches high, and that for turkeys and geese

30 inches. This permits of the birds crated being able to stand erect without injury. The actual dimensions or area required for an individual bird naturally varies according to the numbers and variety to be marketed at one time. Crates 4 feet long by 2 feet 6 inches wide, with a partition in the middle, will comfortably hold sixteen to twenty birds, according to their size and to the prevailing climatic conditions. The object of the partition is to prevent crowding to one end and consequent losses in the event of the crate becoming tilted in transit. A little thought on the part of the producer for birds' comfort in transit would prevent overcrowding of crates. If the crates are well made they will last for some time, as well as ensure the comfort of the birds both in transit and while awaiting sale. Good crates are worth being returned from markets, which obviates the necessity of constantly constructing makeshift crates.

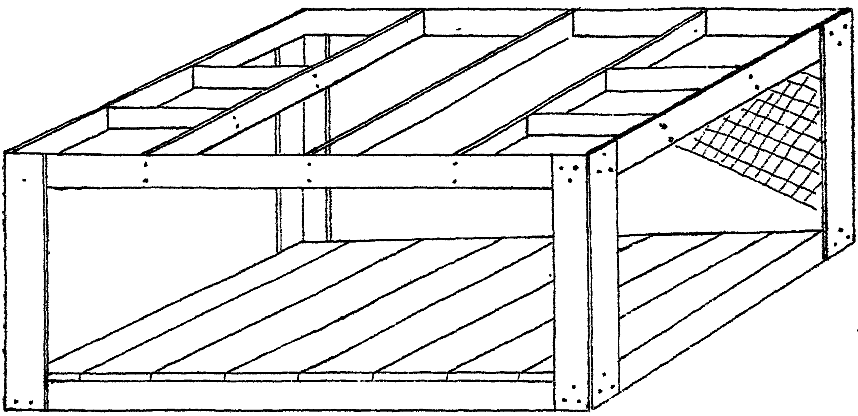


Plate 211.—A Consignment Crate for Poultry.

The sketch illustrates a crate of simple design, the measurements being 4 feet long, 2 feet 6 inches wide, and 18 inches high. It is made entirely of pine, the frame being 3 inches by ⅝ inch, and the bottom 6 inches by ⅝ inch. Doors are provided in the top, and the whole structure covered with 1¼-inch mesh netting. If larger netting is used, it is desirable to place a piece of timber around the frame at least 2 inches higher than the floor to prevent the birds' legs protruding and becoming injured.

There is a correct time for marketing stock, whether they are young or old. Every day they are kept on the farm after reaching sale condition they add to farm costs. If crates are not available at the time the birds are invariably retained, possibly a week or so longer. The crates can, with a little care, be so constructed as to permit of the birds being seen to advantage by the buyers. Under the present conditions of selling, it is a few minutes' work for the assistant to burst open a crate and pass a bird or two around for inspection. Doors placed on the top of the crate would facilitate this work, allowing buyers greater time for examination.

Points in Poultry Marketing.

At present practically the only class of purchaser operating at poultry sales are poulterers and buyers for hotels and restaurants. Small buyers—that is, the household consumers—are unable to buy, for the sufficient reason that the birds are sold per crate at so much per pair. This may be necessary for the purpose of expediting sales, but it

undoubtedly restricts the consumption of poultry meat, and producers would find it to their advantage to market choice stock in small lots.

To what extent the trade of selling dressed poultry is carried on is hard to estimate. The price charged by most poulterers appears excessive, and frequently one notices very inferior stock exposed in windows for sale. There should be plenty of scope for the sale of dressed poultry at reasonable prices, providing it is as easily available to the consumer as butchers' meat and as reliable as regards quality.

Just how a dressed poultry trade is to be worked to the best advantage is difficult to say, but the first essential is a live organisation, with loyal supporters. With cold storage for holding reserves, regular supplies would always be available which would permit of contracts being made with clubs, leading hotels, and other large buyers; as well as supplying regularly, by delivery service, to private homes. Failing a delivery system, the selling of dressed poultry could be made a feature in many butchers' shops, but before this could be done organised effort would be essential.

The individual producer has to consider such questions as the time of marketing, condition of stock, grading, and crating.

Cockerels constitute possibly most of the birds that a producer has yearly for sale, and present greater difficulties by reason of the fact that they have to be disposed of during a relatively short period. They may be sold at various ages, each age having its special advantage. Although most buyers prefer young stock for table purposes, they will not pay high prices for small half-grown birds when larger hens are available, which would proportionately be much cheaper. Having this in view, it is not a desirable practice for the producer to send half-grown cockerels to the market and expect to receive good prices for them during the time when the great majority of our old hens are being disposed of on account of age. This period varies, but usually extends from some time in January until April. Young half-grown birds will find a ready sale from August until the Christmas season. After that period young stock should be well grown to command good prices, but not kept until they become staggy, which is indicated by spur growth.

It is necessary to give some attention to the general condition of the birds to be marketed. No good is done by sending stock low in condition to the selling floor. It is not suggested that any attempt be made to fatten this class of bird, as they generally are constitutionally unfit, and the producer's ends would be better served if they were destroyed, for it may happen that these particular birds will be the first to be examined by prospective buyers.

Cockerels, however, should receive some consideration and not treated, as they too frequently are, as an encumbrance and not worth feeding. If they are to be kept for any time at all they should be well treated and receive the same attention as the pullets; they have to be kept, and if they are to sell to advantage they must be well fed. Rubbish in the way of food is no good. They require, for economical growth, the same ration as the pullets. Keep them free from intestinal worms and dispose of them as early as possible.

Crating should receive the attention previously suggested, and a good layer of straw or grass placed on the floor to ensure the stock being in a clean condition on reaching the market. The birds crated together should be alike as possible as regards age, size, and condition, and of the one variety.

Seasonal Farm Crops.

By C. J. McKEON, Instructor in Agriculture.

POTATOES.

IN most potato-growing districts in Queensland growers are fortunate in being able to grow two crops a year, the first, which is usually sown in August, commonly known as the spring crop; and the second, planted in February, known as the autumn crop. Provided the soil and climate are suitable and good cultural methods are adopted, potato growing can be made a more payable proposition than most other crops: and those who persist with the crop, and are not discouraged by occasional reverses as a result of disease or low prices, find them one of the most profitable crops in the long run.

Potato Soils.

The ideal soil for potato growing is a friable, well-drained, alluvial loam, and one which is sufficiently rich in organic matter to absorb and retain moisture. As a general rule, good lucerne land is also good potato land, but this does not always apply, for lucerne can be grown successfully on the heavier classes of black soil which, unless under the best of conditions, are unsuitable for potatoes. Then again, potatoes can also be grown on some of the lighter sandy loams which could not be regarded as good lucerne land. Clayey soils and those which are badly drained and liable to become water-logged should be avoided, for not only are the chances of raising a crop small, but tubers of good quality cannot be produced on soils of this nature. Even on the best soils, high yields cannot be maintained where the land has been growing potatoes continuously for a number of years, unless care is taken to maintain the physical condition of the soil by keeping up the supply of humus. This can only be done by practising a rotation of crops or by ploughing in a green crop, preferably a legume, such as field peas for winter growth or cowpeas for summer growth. Farmyard manure, where available, is also excellent for this purpose, and also possesses considerable value from a fertilizing point of view.

An early and thorough preparation of the soil is essential to get best results from any crop, but to none does this apply more than to potatoes. Farmers who spend the extra time and labour required to put the land in first-class condition for potatoes will be more than repaid, especially if a dry spell is experienced during the growth of the crop. Under the most favourable conditions good crops may be produced on land that has received a hurried and rough preparation, but in any district the odds are greatly against these conditions occurring other than at rare intervals, and, consequently, the necessity for thorough preparation of the land cannot be stressed too strongly.

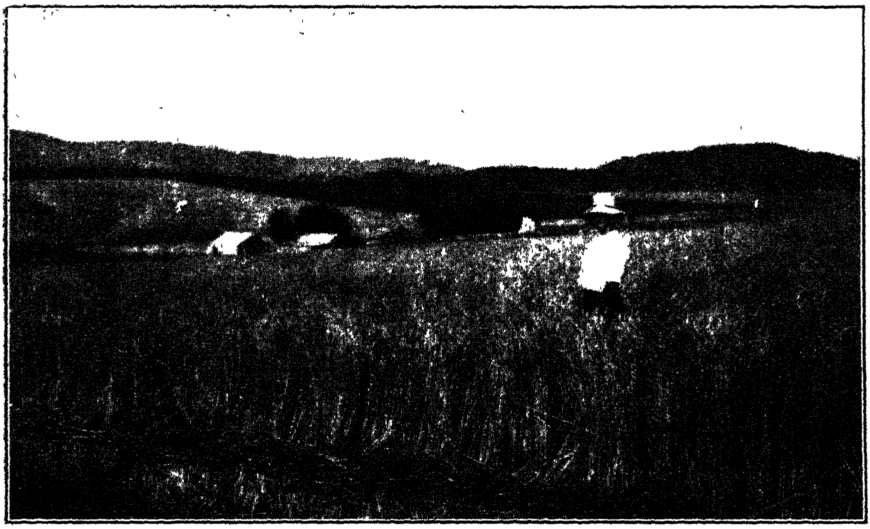


PLATE 212.—A WHEATFIELD AT UPPER FREESTONE, NEAR WARWICK.

"Leave the bustle all behind you; come and let contentment find you
In a cosy little cabin lyin' snug among the wheat."

The first ploughing should be to a depth of at least 9 inches, which will ensure that the seed when planted will have 3 or 4 inches of worked soil beneath it. The land should be left to fallow for a couple of months at least before planting time, care being taken in the meantime to deal with any weed growth which may appear. The use of a spring tooth cultivator or other suitable instrument will not only deal with weed growth, but will maintain the surface soil in good condition. Land prepared in this way will almost invariably be in a sufficiently good condition at planting time to ensure a good germination.

Varieties.

The question as to the most suitable varieties to grow is one that the grower himself will have to determine, either as the result of his neighbours' experience or by conducting trials of his own. Of the white-skinned varieties, Carmens and Scottish Triumphs are by far the most widely grown. Both are good yielding varieties and always command a good price in the markets. Up to Dates also do well in some localities, and come next in order of popularity. Of the blue-skinned varieties, Manhattans are at present the most popular, and are also the most reliable variety. In certain localities Guyra Blues

also give good results, but they do not do well in all districts. Satisfactions and Rough Skinned Brownells are the most widely grown of the red-skinned varieties; neither, however, should be planted in any quantity without first giving them a trial, as they only do well in certain localities.

As growers are compelled, by reason of the fact that locally-grown seed is not available, to use seed which has been imported from the Southern States for the spring crop, every effort should be made to secure seed supplies from a reliable firm of merchants. It is far better to get seed which will prove true to name of the variety which is known to suit the locality, even though it may cost a little more, rather than obtain a cheaper line of seed which may turn out to be anything but the desired variety.

Providing the spring crop is planted early, seed from this can be used for planting the autumn crop planted in February.

All seed, especially that used for the spring crop, should be treated with formalin before planting, otherwise there is a serious risk of disease being introduced. Anyone who may be interested in this treatment can obtain full particulars by making application to the Department of Agriculture.

Any tubers which are not perfectly sound or which, on being cut, show a suspicious looking discolouration should be rejected.

Seed for the spring crop may be cut, but this practice is not advisable in the case of the autumn crop, for hot, wet weather is frequently experienced during February, and, consequently, the cut seed is likely to rot in the ground. Where cut seed is used, the cutting should be done the day before to allow the cut surface to dry. Sprinkling with wood ashes is a practice which is frequently adopted, and is a good one.

Much will depend on the size of the potatoes as to the best way to cut them, but as a general rule the smaller tubers should be cut in half lengthwise, and in the case of the larger tubers the stem end should be cut off at about a third of the length of the tuber, the remaining portion being cut through the centre lengthwise, thus making three sets.

Planting.

Although there are machines for planting, the general practice is to plough the seed in, the seed being planted in every third or fourth furrow according to the width of the plough cut. This practice has much to recommend it, as the furrows are not allowed to remain uncovered for any length of time and the seed can be spaced at an even depth and distance apart. The usual distance between the sets is, approximately, 15 inches at a depth of about 4 inches. They should be planted on the side of the furrow to prevent the horses tramping on them, as would be the case where they were planted along the bottom of the furrow.

The quantity of seed required per acre will naturally depend on the size of the tubers and whether cut or whole seed is being used, but, as a general rule, about 7 cwt. per acre is sufficient.

Cultivation.

The first cultivation should be carried out as soon as the young plants appear above ground. A light tine harrow, preferably a lever

harrow with the tines set back, is the most suitable implement. This cultivation will not only break up the surface soil which may have become slightly caked as a result of rain following planting, but will also destroy any weed growth which has sprung up between the plants. This will be the last opportunity of doing this, for all future cultivations can only be carried out between the rows. The number of inter-row cultivations required will depend on seasonal circumstances, but should be sufficient to keep weed growth in check and, at the same time, keep the surface soil in a friable condition.

When the plants reach the flowering stage they should be hilled; an effective and popular way of doing this is by fitting hilling attachments to an ordinary scuffler. The main advantages to be derived from hilling are that the tubers are protected from the potato moth, and it also prevents tubers which might otherwise have been exposed from becoming discoloured.

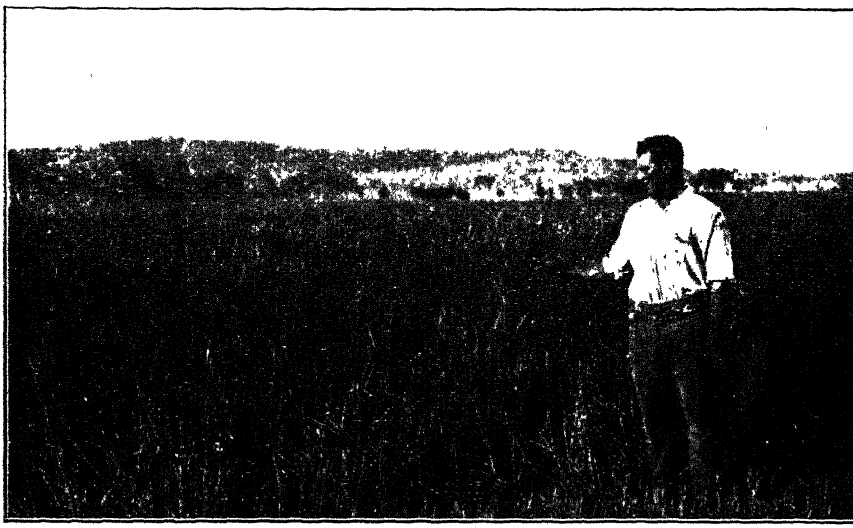


PLATE 213.—A FINE WHEAT CROP AT CAMBOOYA, DARLING DOWNS.

". . . A pleasure in a measure for a man who likes the game."

During growth every precaution should be taken to protect the crop against an attack of Irish Blight, and where there is a likelihood of this occurring, regular sprayings with Bordeaux mixture should be carried out. Frequently, sprayings are not commenced until the disease appears, and it is usually then too late. Spraying with Bordeaux mixture is purely a preventive and not a cure for the disease as many people imagine, and to be successful should be carried out before the disease appears. Full particulars of the preparation and use of Bordeaux mixture appear in a publication on Potato diseases which may be obtained from the Department of Agriculture.

Harvesting.

Regarding harvesting, in the case of the spring crop this is usually carried out as soon as it can safely be done, one of the chief reasons being a desire to get the potatoes on the market as early as possible, as good prices are usually obtainable at the commencement of the season.

The hot weather, and the risk of damage by potato moth, also make it necessary to harvest the crop as soon as possible. In their anxiety to get the potatoes on the market as early as possible growers frequently make the mistake of digging them before the skins are firm enough, with the result that they arrive on the market in a badly rubbed condition and consequently bring a reduced price.

Harvesting is still very largely carried out with a digging fork. A plough is also used at times to turn the tubers out, but although this is a quicker method than hand digging the crop cannot be harvested as thoroughly.

The tubers after being dug should not be left exposed for any length of time to the hot sun, and should be bagged and removed from the field as quickly as possible. When the potato moth is prevalent, on no account should the bagged tubers be covered with the tops or haulms while standing in the field, for this is one of the surest ways of introducing the moth to the bagged tubers.

When preparing them for market they should be carefully graded, for a nice, even-sized line of potatoes will almost invariably command a better price than an uneven sample. Care sould also be taken to reject any tubers which are damaged or showing signs of moth infestation.

SORGHUMS.

Judging by the number of letters that are received from time to time by the Department of Agriculture for information regarding sorghums, it would appear that a considerable amount of confusion exists regarding the different groups. Those of importance as far as this State is concerned may be classified into the following groups:—Saccharine sorghums, Grain sorghums, and Grass sorghums. Broom millet, which is used for the manufacture of brooms, is also a member of the sorghum family. The saccharine or sweet sorghums are one of the most valuable and widely grown fodders throughout the dairying districts of the State, and when cut at the right stage provide not only a nutritious fodder but also a great bulk of fodder. The sweet juices contained in the mature stalks make them highly palatable to dairy and other stock. Although not quite so nutritious as maize, good crops of sorghum can be produced under conditions that would be fatal to maize. Sorghums also possess the advantage of remaining in a succulent stage for a considerable period after reaching maturity, whereas maize rapidly dries off on reaching maturity.

Although the heaviest crops are naturally produced on the more fertile soils, sorghums can be grown successfully on a very wide range of soils; in fact, it can be claimed for them that they will grow on a greater variety of soils and over a wider area of the State than any other cultivated summer crop. Owing to their hardiness and ability to withstand prolonged dry spells better than most other crops, they are of great value to stock owners during dry periods when there is a scarcity of grass or other succulent fodder.

Land Preparation.

To get the best results, it is just as necessary that the land should be thoroughly prepared prior to planting as would be done for any other crop. Owing to their hardiness and their ability to thrive under adverse conditions, less attention is frequently paid to the preparation of the

land for sorghums than crops such as maize, and whilst reasonably good crops are produced under these conditions, much heavier and more even crops will be obtained on well-prepared land.

Planting can be carried out at any time after all dangers of frosts is over and as soon as weather conditions are suitable.

PLATE 214.—A GOOD STAND OF WHEAT ON A FREESTONE FARM.

" For growin' things . . . it makes life sort o' sweet,
An' your conscience never swats you if your game is growin' wheat."

Sowing.

The seed is frequently sown broadcast, but under average conditions this method is not nearly as satisfactory as sowing in drills. This applies particularly to districts where weed growth is prevalent, as it is not possible to keep weed growth in check while the young plants are becoming established. A broadcast crop is also much more difficult to harvest than one sown in drills, and the crop is also much more likely to lodge during wind storms, and where this occurs, particularly in a tall crop, it will remain down and in a tangled position and the harvesting costs are greatly increased. The only advantage to be gained by broadcasting is that a finer stalk is produced. When sown in rows the usual spacing between the rows is about 3 feet, an ordinary maize planter fitted with a suitable seed plate being very satisfactory for the purpose. Where no planter is available, furrows should be opened out with a single furrow mould-board plough to a depth of 4 to 5 inches and the seed dropped thinly by hand in the furrows. A light harrow should be then run along the drills to cover the seed.

Approximately 5 lb. of seed will be sufficient to sow an acre when sown in this manner.

Cultivation.

Sufficient cultivation should be carried out between the rows during the early stages of growth to keep the soil in good tilth, and at the same time to keep down weed growth.

The crop is at its most nutritious stage when the grain is well formed, but still in the thick milk stage, and if the crop is to be used

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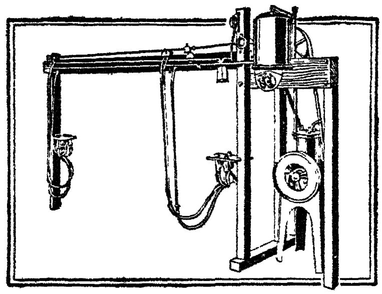

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DUST.	Active Constituents.		Weight.	Price.
		Per Cent.	lbs.	s. d.
BLIGHT DUST SPECIAL ..	Copper Sulphate	20	28	12 0
	Ground Sulphur	10	112	46 0
BLIGHT "20"	Copper Sulphate	20	25	12 6
			100	49 0
TOMATO DUST No. 2 ..	Copper Sulphate	15	28	19 6
	Ground Sulphur	30	112	75 0
	Arsenate of Lead	40		
C. D. SPECIAL	Arsenate of Lead	25	25	15 9
	Copper Sulphate	15	100	61 0
C. D. "50"	Arsenate of Lead	50	25	21 0
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4 lb. packets	1 3
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Lime Sulphur, 1s. 4d. per gallon, in 44-gallon drums.

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Bordeaux Spray, 1s. 5d. per lb., 1 to 7 lb.; 1s. 2d. per lb., 7 lb. and over. Mix 1 lb. of this spray to 25-26 gallons of water.

Terms—Strictly cash with order, less 2½ per cent., plus exchange on country cheques. All prices f.o.r., Brisbane.

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for converting into silage it should be cut at this stage. Where it is required for feeding in a green state, much of it will be naturally advanced much beyond this stage before it has all been cut, but it will still be of considerable food value even for some time after the leaves have been more or less killed by frost.

It is an excellent crop for silage, and when being harvested for this purpose the quickest and cheapest method of doing so is with a maize binder which cuts one row at a time and ties the stalks in bundles. Very few of these machines are in existence in this State, however, and the crop is usually cut by hand with a cane knife.

Varieties.

Numerous varieties of saccharine sorghums have been grown in this State at different times, but only a small number of the best of these have become popular.

Of the quick maturing varieties, Early Amber Cane is the most popular, but it is a light yielding variety when compared with some of the others, and for that reason is not grown extensively.

Saccaline is the most popular variety at the present time and has quite deserved its popularity. It is a tall growing, leafly variety which grows to 11 and 12 feet in height and takes approximately four to four and a-half months to mature. It also has the reputation of retaining its succulence for a longer period after being frosted than most other varieties. Unfortunately much of the seed now available shows signs of inoculation with other varieties, and growers who have pure seed should retain their supplies for future requirements from their own crops. Pure saccaline seed should be a brick red colour.

Planters' Friend or Imphee.

This is a very old and popular variety, and although not so popular generally as Saccaline, still retains its popularity in some districts. It is a very heavy yielding variety and grows under good conditions to much the same height as Saccaline.

White African.

This is another tall growing, heavy yielding variety, but so far has not been grown to any extent in this State. In some of the coastal districts it has given excellent results during the past two or three years and is increasing in popularity.

The varieties already mentioned are those that have so far given the most satisfactory results in Southern Queensland at least.

Honey Sorgho.

In the northern portion of the State a variety called Honey Sorgho has given very good results during recent years and is now very popular. This variety, however, has never become very popular in Southern Queensland.

Grain Sorghums.

The grain sorghums are grown almost entirely for their grain and are not of anything like the same value for fodder purposes as the saccharine sorghums. The stalks do not contain sweet juices like the saccharine varieties, being of a more pithy nature. The yield of forage is also much lower. They are, however, capable of yielding large

quantities of grain which in food value is almost equal to maize. They also have the advantage of being capable of producing a crop of grain on soils which are quite unsuitable for maize, and they are also capable of producing a crop under climatic conditions which would be fatal to maize.

The grain is of considerable value for poultry and stock feeding purposes. The same cultural methods should be adopted as for the saccharine varieties.

Harvesting.

Harvesting has so far been largely carried out by hand, or where a suitable machine is available, the stalks may be cut and stooked in bundles until the grain is thoroughly dry. The heads are then cut off and threshed by a hackler or other suitable machine. Care should always be taken to see that the grain is sufficiently dry before being threshed and bagged; otherwise heating is likely to occur. The fact that so much hand labour is required for harvesting the crop has probably been the reason that grain sorghums are not grown more extensively in Queensland. The Department of Agriculture is at present conducting trials with a large number of varieties from overseas, and amongst these are some highly promising dwarf varieties which, when mature, are only about 3 feet 6 inches high. Should these varieties prove to be good yielders of the right class of grain, the cost of production will be considerably lessened, as harvesting of these can be carried out with a wheat harvester as is being done in U.S.A. at the present time.

Of the large number of varieties which have been grown in the past Feterita, Standard Milo, and Cream Milo have proved the best yielding and most suitable varieties. Red Kaffir has also been grown fairly extensively. Any of the varieties mentioned are capable of giving a yield of sixty bushels of grain per acre under average conditions.

Regarding the grass sorghums, Sudan grass is the only one that is cultivated extensively, although in the past Johnson grass was also cultivated to some extent, but those who were unfortunate enough to introduce it to their cultivation paddocks have never ceased to regret having done so. Whilst it is an extremely hardy crop and also a very useful fodder at the right stage, it is extremely difficult to eradicate and becomes a serious pest. Sudan grass is a very valuable fodder crop and may be used for grazing off, converting into hay, or for silage purposes. It is particularly suitable for the more inland and drier districts, where it is now grown in preference to any other summer fodder crop.

Under reasonably good conditions at least three cuttings may be expected during the season. It is usually sown broadcast or with a seed drill. It is also sown in some districts in drills spaced wide enough to permit of inter-row cultivation being carried out. The quantity of seed required to plant an acre will vary from 5 to 15 lb. according to the method of sowing. Sowing should be carried out as soon as possible after the danger of frost is over, to permit of as many grazings or cuttings being made as is possible.

Grazing Risks.

Although Sudan grass is grown in very large areas each season and is frequently grazed in all stages of growth right throuhout the growing period, there is always a risk in allowing stock on a crop before the flowering stage is reached. It will readily be admitted that thousands

of dairy stock are grazed on the crop each season, particularly in the Darling Downs and Maranoa districts, and suffer no ill effects. Cases of poisoning, however, do occur and serious losses result, as instances have come under the notice of the Department of Agriculture where a large proportion of the herd was wiped out. For a very long time the general opinion was that pure Sudan grass was not poisonous at any stage of growth, and that poisoning only resulted on crops which had been inoculated with other varieties of sorghum. This, however, does not appear to be the case, as in several cases that have been investigated, there was no evidence that the crop was not pure. Past experience would appear to definitely indicate that the risk attached to grazing or an immature crop is very slight if the crop has been well grown. Where a crop has received a severe check from dry, hot weather and the growth is stunted, and this applies particularly to a ratoon growth, there certainly is a very serious risk attached to grazing the crop off before it flowers.

Plate 215.—Another Good Wheat Crop at Cambooya.

"I am the song that the need of man has sung
From the soil at his feet."

The saccharine and grain sorghums are very definitely dangerous before reaching the flowering stage, and whilst it is claimed that certain varieties are less poisonous than others, this has not yet been definitely proved, and consequently it is not advisable to take the risk with any of them.

SUMMER GRAZING CROPS.

Cowpeas.

As farmers are now busily engaged in preparing land for summer grazing crops, some of the most useful of these will be briefly discussed in these notes. One of the most valuable of these is cowpeas, and although they have been grown for a great number of years and have proved conclusively that they will thrive over a wide area of the State and on a wide range of soils, they are not grown as extensively as they

might be. Their value as a green manure crop is much more widely recognised than their value as a fodder crop. They make a highly nutritious hay, but they are not an easy crop to harvest and cure and consequently are not widely grown for hay purposes.

For dairymen no more valuable crop could be grown for grazing purposes. Some difficulty is usually experienced at first in getting dairy stock to take to them, but once they acquire a taste for them they eat them readily, and their value as a milk producer will then be quickly demonstrated.

One of the best ways of getting the stock accustomed to them is to make a light sowing of maize or other strong growing crop amongst the peas. The trailing or twining varieties will twine round the maize stalks and the stock cannot avoid eating them whilst eating the plants of the other crop, and in this way will acquire a taste for them.

They can be grown on most classes of soil, provided the drainage is reasonably good, and they do not require any more favourable weather conditions than the average crop.

They will not thrive under cold conditions and should not be sown until all danger from frost is over. They are frequently sown broadcast, but sowing in drills is to be preferred. The usual width between the rows is 2 feet 6 inches to 3 feet with 8 or 9 inches between the plants. For broadcast sowing from one half to one bushel of seed is required to sow an acre, according to the size of the seed. When sown in drills from 5 to 15 lb. will be necessary.

When used for grazing purposes they not only prove a valuable milk-producing crop but will greatly improve the soil after the residue has been ploughed under.

Where the crop is grown solely as a green manure crop, difficulty will be experienced in satisfactorily ploughing under a heavy crop if the work is not carried out in a proper manner.

To do this successfully, the crop sould be first of all flattened by rolling, and where a disc cultivator is available the process of ploughing the vines under will be more easily and effectively done if this machine is run over the rolled crop before commencing ploughing. The best stage at which to plough the crop in is when the pods have developed, but before they have started to ripen. A crop which has been allowed to mature too fully will become woody and consequently more difficult to plough under. As was previously mentioned, properly cured cowpea hay is very nutritious and it is also very palatable to stock. In curing, a certain amount of care is necessary to prevent loss of leaf. To avoid this the cut crop sould not be allowed to remain exposed to the hot sun for too long a period, and should be placed in loosely built cocks or heaps before the leaves become brittle. To effect an even cure the cocks should be turned occasionally.

The most popular varieties are Black and Poona. The Black is a very old and popular variety which has proved to be a heavy cropper.

The Poona variety has come more into prominence during recent years and is now very popular in some districts. It is also a heavy cropper and can quite easily hold its own with the Black variety in this respect.

Quite a number of different varieties are grown throughout the State, but the two varieties mentioned are the most widely grown.

Soy Beans.

Considerable interest has recently been shown regarding the growing of Soy beans. The Department of Agriculture has been conducting trials with these over a number of years, and whilst excellent results have at times been obtained the difficulty so far has been to secure varieties which will give consistently good results.

Other countries which are now growing them extensively experienced much the same difficulty at first, but once this problem has been overcome they have proved a valuable crop.

Although they are highly valued as a human food in countries such as Japan, their chief value in this State, for some time at least, would be for fodder and soil improvement purposes.

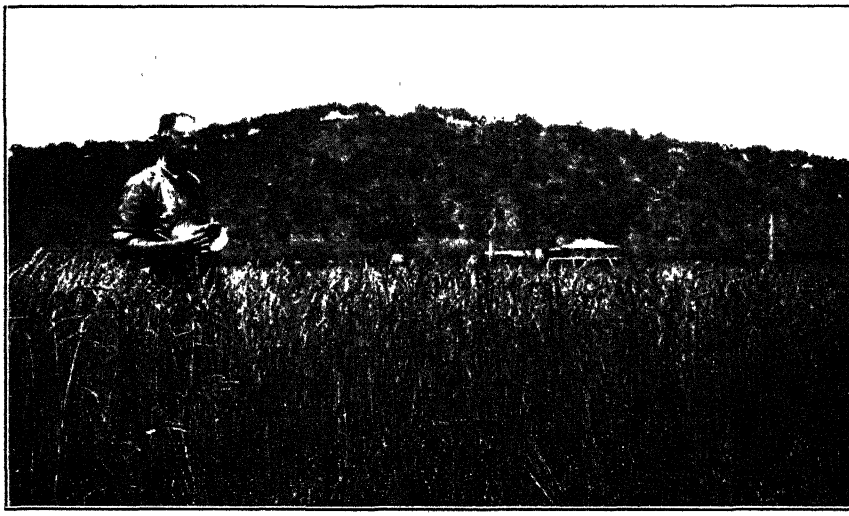


PLATE 216.—A PADDOCK OF "PUSA" AT PILTON.

"Wheat, wheat, wheat! Oh, the sound of it is sweet!
I've been praisin' it and raisin' it in rain an' wind an' heat
Since the time I learned to toddle till it's beaten in my noddle
Is the song I'm singin' you of wheat, wheat, wheat."

The seed is valuable for oil extraction purposes and also for the manufacture of Soy bean flour, but it is doubtful if the seed could be produced here for the price at which it can usually be imported from countries where labour is cheap.

The plants contain a very high percentage of protein, and as they are palatable to stock either as a green fodder or in the form of hay, they would be of value for this purpose alone.

They also have a beneficial effect on the soil, and in countries where they do well are greatly valued for this purpose.

The results of the trials so far conducted would indicate that this crop will grow on most reasonably good soils provided the drainage is good. The young plants are fairly tender, and for that reason the surface soil should be well worked and should not be allowed to become caked prior to germination. Once the plants are established they are

fairly hardy and will stand a dry spell as well as most other crops. They are susceptible to frost, and sowing should therefore be delayed until all danger of frost is over.

The seed should be sown in rows spaced at least 2 feet 6 inches apart with about 6 inches between the plants. They should not be sown deeply, a depth of 3 inches in a well-worked soil being sufficient. The seed of the different varieties varies greatly in size and consequently the quantity of seed required to sow an acre varies. Approximately 5 lb. of seed is sufficient for the small seeded varieties and about 10 lb. per acre for the large seeded varieties.

If the crop is being grown for hay purposes it should be cut when the seeds are about half formed.

To prevent loss of leaf the same care would be necessary in curing the crop as would be the case with cowpeas.

A crop that is grown for seed should be cut when about three-quarters of the pods are ripe. The pods do not all ripen at the same time, and if the cutting were delayed until all the pods had ripened many of those which ripened first would have shed their seed. The seed should be allowed to dry out thoroughly before being threshed and bagged, as it heats very readily where this is not done.

Regarding varieties, a large number have been tried so far, and those which have shown the most promise are Otootan, Biloxi, and Laredo, particularly the two former. Otootan is the most leafy and lightest stalked of these varieties, and shows distinct promise as a fodder variety. The other two varieties are also tall-growing, leafy varieties, but are not as fine-stalked as Otootan.

From a grain point of view, Biloxi would probably prove the most suitable variety. These are fairly late maturing varieties and should be sown not later than November in the coastal districts and earlier than that in districts where early frosts may be experienced.

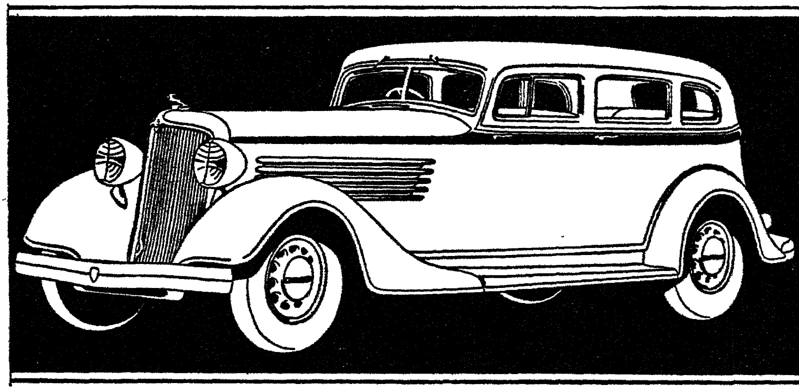
Of the quick maturing varieties, none has shown more promise than one known as A.K. 2. This variety was introduced last season by the Ford Motor Company and the seed was kindly forwarded to the Department of Agriculture for trial purposes.

To save any disappointment to those who may wish to secure seed of Soy beans it is as well to point out that until something more definite is known regarding the suitability of the different varieties only sufficient seed is being retained for experimental purposes. No variety has yet given consistently good results to recommend their growth in preference to cowpeas.

Millets.

For a quick growing summer grazing or hay crop, particularly for the coastal districts, the millets, or what are commonly known as panicums, have proved the most suitable. They can be grown on almost any soil that could be classed as worthy of cultivation.

They are usually sown broadcast at the rate of 12 to 15 lb. of seed per acre. They can be sown as soon as frosts are over and, given favourable weather conditions, will provide good grazing within five or six weeks from the time of sowing. They should not, however, be grazed too early but should be allowed to reach a height of 8 or 9 inches when they will have usually a sufficiently strong root growth to stand grazing.



If the crop is not allowed to become too mature before being grazed, a good second growth will appear, which can either be used for grazing purposes or for converting into hay.

When being used for hay the crop should not be allowed to mature the seed, but should be cut when the grain is forming.

Apart from the loss of food value in an over-matured crop, most varieties shed their seed freely, and this will germinate freely the following season. This would be of little consequence where the same land was again required for this crop, but where a crop such as maize or potatoes was to be grown, extra work would be entailed in cultivation to deal with the volunteer growth.

Plate 217.—Wheat Lands at Upper Freestone, Darling Downs.

"Wheat, wheat, wheat! Oh, the people have to eat!
An' you're servin' and deservin' of a velvet-cushion seat
In the cocky farmers' heaven when you come to throw a seven;
An' your password at the portal will be wheat, wheat, wheat."

It will be found that most varieties dry out more slowly than most other hay crops, but when properly cured make a very nutritious hay.

They are also of value for silage purposes either for mixing with a heavier stalked crop such as maize or sorghum or for using alone.

When used for this purpose the crop is much more easily handled both in the field and while being ensiled if cut with a reaper and binder.

Of all the varieties grown, White Panicum and Japanese Millet have given the best all-round results. They not only have proved to be heavier yielders, but are better stoolers and provide better grazing.

The best of the other varieties are Hungarian and Manchurian Millet and what is commonly called Giant Panicum or Liberty Millet.

Grasshopper Control.

By ROBERT VEITCH, B.Sc. Agr., B.Sc. For., F.R.E.S., Chief Entomologist.

GRASSHOPPERS have been hatching out in abnormally large numbers in Southern and South-Western Queensland during the past two weeks, and agriculturists and pastoralists in the infested areas are faced with the prospect of very serious losses of crops and pasturage if adequate and immediate steps are not taken to deal with the generation of hoppers that is now emerging.

The Present Outbreak.

Eggs were laid by winged grasshoppers in May of this year, and these eggs overwintered in the soil until the middle of September, when the young hoppers commenced hatching out. Many are still on the egg-bed sites or comparatively close thereto, and relatively little damage has as yet been inflicted. The ground in some places is almost black with the young hoppers, but in spite of their numbers the situation is not yet out of hand and control can be established if immediate action is taken. Once they have reached the winged stage, however, the control of plague grasshoppers is virtually an impossibility, and it is generally considered essential to deal with the hoppers not later than three or four weeks after their emergence from the egg-beds and while they are still wingless.

Control Measures.

Many measures have been recommended for dealing with grasshoppers, but the use of poisoned bran bait has practically displaced all other methods of fighting these pests except in very cheap labour countries.

Arsenic in various forms is employed as the poison in the bait, the arsenical generally used being sodium arsenite.

The following is the formula of a bait that has proved very effective:—

Arsenite of soda	½ lb.
Molasses	4 lb.
Bran	24 lb.
Water	3 gallons.

The arsenite of soda, or sodium arsenite, which is best obtained in a powdered form so that it is readily soluble, should be dissolved in hot water, the solution being then allowed to cool. The molasses is subsequently added and the mixture stirred until the molasses is thoroughly dissolved. This mixture is then added to the bran, which is worked up until a good crumbly mash is obtained. The mash should trickle through the fingers and should not be made mushy by the addition of too much water. As far as practicable it is desirable to avoid mixing the bait by hand especially if cuts are present, and it is, of course, essential to wash the hands thoroughly after the preparation and application of the bait.

The bait as prepared is broadcasted in a very finely divided state over the ground infested by the young hoppers, and experience indicates that the quantity prepared according to the formula just given is sufficient to treat two-thirds of an acre. In cases where the

grasshoppers are advancing in swarms the bait may be scattered over a 30 to 50 feet wide strip in front of the advancing hoppers. The bait is generally best applied in the forenoon, but local observations may indicate that application is desirable at some other time of the day. The important point to note is that hoppers habitually feed during the day, and the bait should be scattered when they are both active and hungry. Those using the bait should accordingly make sure that it is being eaten readily by the hoppers and, if necessary, should alter the time of application to ensure early and active feeding on the newly applied bait.

The young hoppers do not commence dying until about twenty-four hours after feeding on the bait, but when forty-eight hours have elapsed the mortality is high. In the late afternoon the hoppers congregate on small shrubs and tufts of grass, and on dying they fall to the ground. Hence if one looks under such a shrub or tuft of grass on a baited area one can find literally thousands of dead hoppers although numbers of dead are also scattered about in the open. Queensland experiments have demonstrated that poisoned bran bait gives an excellent kill of the hoppers, and as an efficient and inexpensive control measure is available, primary producers are strongly advised to use the weapon that is placed in their hands.

The degree of safety associated with the application of this bait is a matter of considerable importance, and with respect thereto the position is that it contains an arsenical poison, and it must accordingly be prepared and applied with discretion. The bait must be scattered in a very finely divided flaky state and not in lumps that can be picked by by stock. Fowls should not have access to it, and the utensils in which it has been mixed or in which it is stored should not be accessible to live stock. The position would appear to be that if intelligently applied the danger to stock is nearly negligible. Enormous quantities of poisoned bran bait are used throughout the world for the control of grasshoppers, and the general opinion seems to be that the element of risk entailed in its application is very slight. Of course, as already indicated, the bait must be used with discretion and every reasonable precaution taken to ensure its safe application, for obviously no guarantee can be given that nothing can possibly go wrong.

As already stated, the use of poisoned bran bait is the standard measure for grasshopper control. Another control measure is, however, worthy of mention as a temporary expedient—namely, the dragging of burning old bags or similar material over the dense swarms of young hoppers. Such bags may be sprinkled with kerosene, and on being lit and dragged over the infested area it will be found that large numbers of hoppers have been killed. Such a control measure is, of course, much more laborious and not nearly so efficient as the baiting system already described. Nevertheless it may serve a useful purpose until the necessary ingredients for baiting are obtained.

A PROGRESSIVE JOURNAL.

A farmer writes (*10th September,* 1934):—"*The Journal, always admirable, has continued to make progress, and in its present form is a publication reflecting great credit upon all responsible.*"

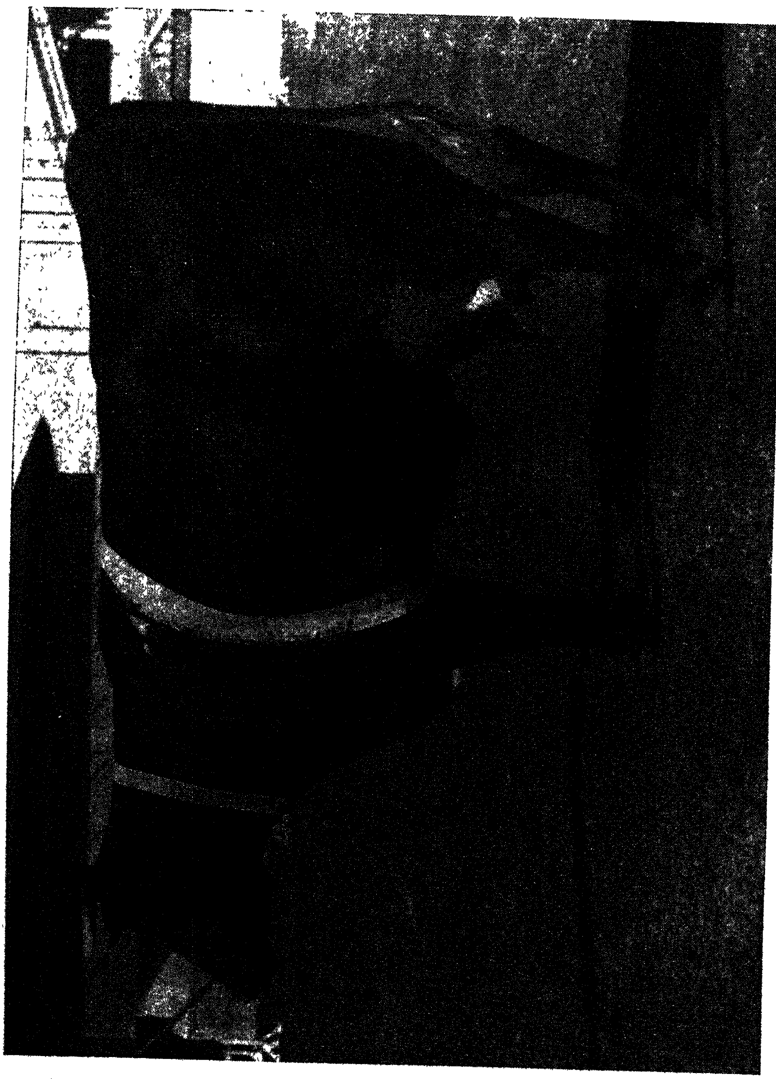


Plate 218.
Champion A.I.S. Butter-fat Cow at the Brisbane Show, "Evelyn of Sunnyview," the property of Mr. J. Phillips, Wondai.

Plate 219.

Champion Jersey Cow at the Brisbane Show, "Oxford Ginger Girl," the property of Messrs. E. Butler and Sons, Wanora, Brisbane Valley.

PLATE 220.
Champion A.I.S. Cow at the Brisbane Show, "Myrtle IV. of Lemongrove," the property of Mr. J. Phillips, Wondai.

Plate 221.
Champion Ayrshire Cow at the Brisbane Show, "Fairview Lady Bess," owned by R. M. Anderson, Myola, Southbrook.

Answers to Correspondents.

BOTANY.

Hexham Scent.

F.C. (Wynnum West)—

The specimen represents *Melilotus parviflora*, the Melilot or Hexham Scent. It is a plant resembling lucerne in appearance, and is quite common at this time of the year, growing until about October or November, when it dies off with the approach of hot weather. It was much boomed some years ago as a fodder under the name of King Island Melilot, but, on the whole, our experience in Queensland has been that stock do not take readily to it. It has a value for growing on land where other legumes will not thrive, but has the bad property of tainting milk and cream. It is quite common on the Darling Downs, and sometimes the seeds get mixed in with wheat, and, owing to their peculiar odour and flavour, cause a good deal of trouble.

Burr Trefoil; Prairie Grass.

W.G.B. (Bancroft)—

The specimens have been determined as follows:—

1. *Medicago denticulata*, Burr Trefoil. A vigorous-growing Trefoil, very common about this time of the year in parts of Queensland. It is quite a valuable forage, but dies out on the approach of the hot weather, about October or the middle of November. When it dies down it leaves a mass of burry pods, but these are greedily eaten by sheep, and the damage they do to the belly wool is more than counterbalanced by the forage features. In its green and luscious state it is apt to bloat stock rather badly.

2. *Medicago minima*, the small Burr Trefoil. Much the same remarks apply as to No. 1.

3. Prairie Grass, *Bromus unioloides*. One of the best known winter fodders. It very often comes up spontaneously in cultivated ground. It is an annual grass, and dies out in early or late summer.

Portuguese Elm; Bauhinia.

E.J.C. (Caboolture)—

The specimens have been determined as follows:—

(*a*) *Celtis sinensis*, a native of Western China. It belongs to the Elm family and is often called in Queensland Portuguese Elm. It makes an excellent shade tree and the leaves are much relished by stock. The tree is propagated from seeds which are borne in abundance, if we remember rightly, about January or February. Though we have not tried to do it ourselves, we think there is a good possibility of striking the plant from cuttings.

(*b*) *Bauhinia variegata*, a native of India, China, and Java. A very handsome tree, much cultivated in tropical and subtropical countries on account of its showy flowers. There is a form with pure white flowers (*Bauhinia candida*).

The Scarlet Pimpernel; Groundsel.

M. D. O'D. (Gympie)—

1. *Anagallis arvensis*, the Scarlet Pimpernel, a common European weed now abundant in Queensland and the Southern States. It is recorded as poisonous, but is mostly left untouched by stock. Some years ago, however, we received a number of seeds from the paunch of a cow that had been poisoned at Buderim Mountain, evidently through eating this plant. Dr. Gilruth has also recorded poisoning of sheep in Victoria through it.

2. *Baccharis halimifolia*, the Groundsel Bush, very common now on the North Coast line, favouring country on the coast subject to inundation, but by no manner of means confined to such places, for it is found on the Blackall Range and in other localities. It has been accused of poisoning stock, but feeding experiments carried out with it some years ago at Yeerongpilly showed the plant to have no feeding value whatever, but not to be definitely poisonous.

Cape Cotton.

O.C. (Macalister)—

The plant is *Gomphocarpus fruticosus*. commonly known as the Balloon Cotton or Bladder Cotton, and sometimes as Cape Cotton. It is a native of South Africa, and is now a common naturalised weed in parts of Queensland, particularly on coastal scrub farms. On odd occasions we have seen it as thick as Inkweed or Scotch Thistle. It is often grown as an ornamental plant, or as a curiosity on account of the inflated seed pods. It belongs to a dangerous family of plants, the *Asclepiadeæ*, and has been suspected of causing losses on one or two occasions. Stock, however, rarely touch it, or at least in sufficient quantities to cause trouble. The silky cotton which surmounts the seeds has no value for textile purposes, being too short and brittle, but the bark contains rather a strong fibre.

Grasses from South Burnett Identified.

Winter Fodder Club (Goomeri)—

The specimens have been determined as follows:—

(1) *Poa annua*, Annual Meadow Grass, a common European grass very common in Australia, mostly as a weed of cultivation, though in some localities it has invaded the ordinary pasture. It seems to be readily eaten by stock, and to be quite a useful winter and spring fodder, though not giving a great bulk of feed.

(2) *Bromus unioloides*, Prairie Grass, one of the best known winter fodders.

(3) *Setaria glauca*, Pigeon Grass. Very closely allied to the grasses grown in Queensland under the name of Hungarian Millet, Italian Millet, Panicum, &c.

(4) *Vulpia myurus*. Rat's Tail Fescue, a common weedy grass of no value as a fodder, so far as we know. It is quite common as a winter and spring weed in cultivation in Southern Queensland.

(5) *Bothriochloa intermedia*, a species of Blue Grass, and a valuable grass in the mixed native pasture.

South-Western Grasses Identified.

W.I.B.B. (Dirranbandi)—

The specimens of grasses have been determined as follows:—

(1) *Eriochloa* sp., Early Spring Grass. Species of *Eriochloa* are particularly palatable and nutritious. We do not think, on the whole, however, that they are particularly drought-resistant. Though they are common during the summer months, they often come in with an early spring and provide succulent forage when other feed is scarce.

(2) *Panicum decompositum*, one of the commonest grasses in the West; sometimes known as Barley Grass, at other times as Native Millet. It is quite a good native grass.

(3) *Bothriochloa intermedia* (?). Better material required to be sure. *B. intermedia* and its allies are quite good pasture grasses.

(4) *Chloris truncata*, a species of Windmill Grass, as far as can be told from the very scrappy specimen. All the Chloris grasses are particularly good. They are generally abundant in cleared brigalow country and always afford a bite for sheep, making good basal growth, even during the autumn and winter months.

(5) *Atriplex Muelleri*, a species of Saltbush. This, we think, is the commonest Saltbush in Queensland. It is, generally speaking, not favoured by stock, though they seem to take to it more readily when it is dying off.

We are not too sure of the botanical names of your common Roley-poleys or Bindy-eyes, as these names vary so in different localities.

Regarding plants to try in your district, the only grasses we can think of at the moment are Woolly Finger Grass (*Digitaria eriantha*) for your sandy country, and Blue Panic (*Panicum antidotale*). Seed of the latter is obtainable from Messrs. J. Jackson and Co., seedsmen, Brisbane.

The sensitive plant referred to by you is purely a herb or fodder plant for the coastal districts of the State, particularly the northern or more tropical portions.

Groundsel.

E.L.P. (Cooroy)—

Your specimen represents the Groundsel Bush (*Baccharis halimifolia*), a very common weed on the North Coast line, smothering much of the swampy country between the line and the coast. It is, however, by no means confined to such places, and sometimes makes its way on to the scrub farms of the Blackall Range, D'Aguilar Range, and other high lands, but does not seem to spread to the same extent in those places as it does in the coastal swamps.

The plant is spread by seeds, which are borne on the female plant in tremendous abundance. They are white and feathery, and are often picked on this account by passing motorists and others for decorative purposes, are blown about the country, and this is one way by which the plant is spread. As a species of Baccharis in the Argentine has been proved poisonous to stock; feeding tests were carried out some years ago at the Animal Health Station, Yeerongpilly, with the present plant. Animals were fed for about a fortnight, and we should say they ate during that period a good deal more of the plant than they would under normal conditions. Generally speaking, stock do not take very readily to the plant, although occasionally, for some reason or other, they will punish it rather severely. So far as the feeding tests at Yeerongpilly are concerned, though the animals were very emaciated at the end of the tests, they recovered when put on to ordinary feed; hence we do not think that the plant is as poisonous as many suppose, but it has little or no feeding value.

Wild Verbena. A Species of Bassia.

A.C.B. (Alton Downs)

(1) The plant from Alton Downs is *Verbena tenera*, a native of South America. It has for many years been a common naturalised weed about some of the western townships, particularly about Roma and Wallumbilla. About Roma it is one of the commonest town weeds, but does not seem to have spread, so far as we know, to any great extent into adjacent farms. It was, no doubt, originally introduced as a garden flower. This is the first specimen we have received from Central Queensland. It is generally called Wild Verbena.

(2) The thorny plant from Theodore is *Bassia tricuspis*, a species of Bassia that seems very much on the increase. As you know, the Galvanised Burr belongs to the same genus, but some allied species, including the present one, seem to be becoming almost as serious pests. Bindy-eye is a name sometimes applied to it, but this name is rather loosely applied to quite a number of burr plants in Queensland.

Water or Wild Millet.

L.M. (St. George)—

The specimen of grass is *Echinochloa Walteri*, sometimes called Water Millet or Wild Millet. It is a useful pasture grass closely allied to such well-known cultivated fodders as Japanese Millet or White Panicum, but is only suitable for growing in wet situations. The specimen was of great interest to us, as it is the first we have seen from inland parts, although the grass is moderately common on the coast.

Burr Trefoil.

D.F.K. (Tara)—

The specimen is the Burr Trefoil (*Medicago denticulata*), a very valuable winter and early spring fodder. It should do quite well in the Tara district in an average winter, and is worth every encouragement. Stock seem to prefer the plant when it is dying off rather than when it is green and luxuriant, but even the dried plant covered with its little seed-pods is quite nutritious. The burrs that follow the seed-pods are rather objectionable in the belly wool of sheep, but the good qualities, we think, outweigh the bad. Once it becomes established on a property it generally spreads of its own accord, but if you wanted to sow seed, this is stocked by some nurserymen and is listed by Arthur Yates and Co., Sussex street, Sydney, who would give you particulars as to price, &c. Seed should be sown preferably in April or May.

General Notes.

This Month's Cover Design.—An Acknowledgment.

For the photographic print used in this month's cover design we are indebted to the Editor of the "Courier-Mail," who has courteously permitted us to reproduce the striking farm scene at St. Lucia, which appeared originally in pages of his paper.

Staff Changes and Appointments.

Messrs. K. R. Hack (Nerang) and J. Wilson (Hunchy) have been appointed Growers' Representatives on the Banana Industry Protection Board.

Mr. P. T. Smith, of Kiamba, has been appointed an Honorary Inspector under the Diseases in Plants Acts.

Sub-Inspector J. Henderson, Townsville, has been appointed also an Inspector under the Slaughtering Act.

The Officer in Charge of Police, Oakey, has been appointed also an Acting Inspector of Stock.

The appointment of Mr. A. E. Adcock (caretaker of the Wambo Shire Council Dip at Dalby) as an Acting Inspector of Stock will be cancelled as from the 1st October next.

Mr. G. W. J. Agnew, of Gatton, has been appointed an Inspector under the Diseases in Plants Acts, Department of Agriculture and Stock.

Mr. D. F. Keith, Inspector of Dairies at Crow's Nest, has been appointed Grading Inspector, Department of Agriculture and Stock.

Mr. H. B. Ford, Inspector of Stock, Ravensbourne, has been appointed also an Inspector under the Slaughtering and Dairy Produce Acts.

The Officer in Charge of Police, Tully, has been appointed also an Acting Inspector of Stock.

Mr. A. F. S. Ohman, Government Veterinary Surgeon, Brisbane, has been transferred to Toowoomba.

Mr. S. C. Allan, Inspector of Stock, Crow's Nest, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. G. Ollett, Secretary of the Marian Mill Suppliers' Committee, has been appointed Canegrowers' Representative on the Marian Local Sugar Cane Prices Board in place of Mr. G. H. R. Dark, deceased.

Constable J. A. Schick, Bedourie, has been appointed also an Inspector under the Slaughtering Act.

Mr. H. B. Carney, Clerk of Petty Sessions, Ingham, has been appointed Chairman of the Macknade and Victoria Local Sugar Cane Prices Boards in lieu of Mr. J. A. Murray, resigned; also an Agent of the Central Sugar Cane Prices Board for the purpose of making enquiries under Section 5 (2A) of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands.

Mr. M. R. Muller, Inspector under the Stock, Slaughtering, and Dairy Produce Acts, has been transferred from the Oxley Bacon Factory to Gladstone; and Mr. G. R. Sigley, Inspector of Stock, Slaughtering, and Dairying, from Gladstone to the Oxley Bacon Factory.

The Peanut Board.

The Peanut Board election for two growers' representatives for Districts Nos. 1 and 3 for a term of two years resulted as follows:—

District No. 1 (Nanango and Wienholt)—

Leslie Vivian Young (Wooroolin)	163 votes.
Norman James Christiansen (Wooroolin)	157 votes.

District No. 3 (Rest of Queensland except Central Queensland)—

Albert George Whiting (Atherton)	62 votes.
Daniel Macdonald (Biboohra)	3 votes.

Mr. Christiansen, the present member for District No. 1, has been replaced by Mr. Young; and Mr. Whiting has been re-elected for District No. 3 by a considerable majority.

Police Reserve at Marlborough a Sanctuary.

The Police Reserve at Marlborough has been declared a sanctuary under the Animals and Birds Acts. Native animals and birds will, in future, be protected on this reserve.

Rural Topics.

The Art of Advertising.

"I do not pretend to be an expert," said the Prince of Wales the other day at the annual dinner of the Advertising Association, "but I have studied the questions of salesmanship and advertising, not from statistics, but from any years of travel, not only in this country but throughout the world, hearing for myself and seeing for myself. Experience has taught me that just as unmined gold has no value, so are manufactured goods, hidden away in warehouses and factories, useless until made known and made desirable by the art of advertising." The Prince also expressed the opinion that advertising is more urgently needed to-day than ever, and that upon the efficiency with which it performs its task much of our prosperity must depend; and it was evident from his references to advertising methods that he has given the subject very close attention.

A Typical Bull's Head—Illawarra Breed Type.

In all dairy breeds a good deal of importance is attached to the head of the bull. Mr. A. M. Hunt, president of the Australian Illawarra Shorthorn Society, recently described what he considered should be a good standard head. It should be masculine and full of breed character, clean cut and well moulded; of medium length in proportion to size of animal. Forehead broad and slightly dished between the eyes, of medium length, well moulded, and narrowing a little below horns. The hair on the forehad either curly or rather long, but should be of good quality. The horns either short or of medium length, set well apart on crown of head, and of a waxy or creamy appearance, oval shaped at base, and of medium thickness, gradually tapering and continuing forward on a level with top of crown, and with a slightly upward or downward tendency at points, the latter preferred. Coarse, over-long, heavy or cocky horns objectionable. Full, clear, prominent eyes of a bluish tinge, and set well apart, and encircled by an orange-tinted skin, either free of hair or with very fine short hair. The face, from eye to muzzle, should be of good length, strong and well chiselled, and not dished, joining on to a clean, square, fairly broad, flesh-coloured muzzle. Mouth of medium size, lips not heavy, but nostrils well defined and open. Cheeks and jaws flat and fine, covered with shortish hair. Under-jaw well developed and fairly flush with mouth, with very little loose skin underneath. The ears of medium size set on level and with short silky hair, and plenty of secretion inside. When viewed from any angle the head and horns should harmonise with the body and give the appearance of masculine strength, vigour, yet refinement.

Value of Good Udders.

Mr. Cuthbert Nairn, of Sycamore Farm, Pennsylvania (U.S.A.), has a word to say in the "Ayrshire Digest" about the need for maintaining breed type:—

"I want a cow that has striking breed character, ample capacity, real dairy type, and quality throughout her entire make-up. By capacity, I mean those important parts of a cow that are responsible for her being able to produce efficiently. I haven't much use for a cow that is now a profitable producer.

"I have never seen a real cow that did not have plenty of digestive capacity and the ability to handle an abundance of feed.

"The udder is the most important part of the cow. A poor udder is about the worst fault that a cow can have. . .

"There are real advantages in having udders built right. Udders that are so built are protected from injuries that come to udders that hang down where they are easily struck or stepped upon. They are easier to keep clean. It is easier to make clean milk from them and there is no question but what they wear better. . .

"Some cows become worthless because of their undesirable hind legs, which should be nearly straight when viewed from the rear with the hocks squarely set. If a cow has the right kind of feet and legs she can stand long years on concrete. . .

"You will agree with me that it is a lot easier for the cow that is built right to produce efficiently year after year than the cow that is not properly made. . ."

Safeguarding the Cow—Her Economic Value.

In the course of an article in the Ayrshire Cattle Society's Journal on "Producing the Milk," A. D. Buchanan-Smith, Institute of Animal Genetics, University of Edinburgh, said:—

"If a cow has the inherited potentiality of 2,000 gallons per lactation, it would probably be enough to feed her so that she yields just rather under that. It would be positively dangerous to try to force her above her potential production. There can be no doubt that the chairman of the Milk Marketing Board was correct in questioning the advisability of forcing cows to their uttermost limits, and not merely squeezing, but positively extracting, by torture, the last ounce of milk from them. On no account should the method of feeding adopted be beyond the inherited capacity of the cow.

"The other point that emerges quite clearly is this: High milk production in one lactation is not enough. What is required is an inherited capacity for high yield, plus long life. Supposing we have a cow capable of giving 1,200 gallons. If we force her so that she gives 1,300 gallons, we would possibly put her off her legs and she would not live long. Accordingly, she should be fed for rather under her hereditary capacity, and we should hope to get a long life out of her. Attention to the feeding question, however, will not alone make a cow live a long time. Not all cows die a natural death. They get troubled with their udders, with their feet, with their legs, and with their reproductive organs. It is those troubles which cause a cow to be put out of the herd, and so shorten her life. It is the cow who has the hereditary capacity for withstanding these troubles that is the economic cow. A good, hard-wearing udder, good legs, good feet, the capacity to reproduce regularly, are subject both to nutrition and heredity. The two must work hand-in-hand, and of course there must be adequate control of disease.

"How, then can we measure the economic value of a cow? The mere yield of a single lactation is not a very reliable indication. It may indicate a bad cow, but it cannot reveal a good one. What is of prime importance is that the cow should have given a good yield for a long period. Therefore, when we talk about the 10,000-gallon cow, or hear the Americans talking about the 100,000-lb. cow, then we are hearing about valuable animals, especially if those high yields have been compiled by an average of 1,000 gallons per year over a period of ten years. There can be very little room for doubt that such cows are truly economic and remunerative to their owners. From a productive standpoint, that is the ideal cow of the Ayrshire breed, the four thousand pound butterfat cow."

Mange Cure.

We are frequently appealed to for a remedy for dogs affected with mange. We recommend the following, which we have found very effective in almost every case where it has been applied in time. Don't wait until the dog is hopelessly affected before commencing treatment.

Wash affected parts with soft soap and warm water an hour before applying.

Apply 1 dr. creosote, 1 dr. liquor of potassa, 12 drs. olive oil. Repeat twice weekly.

Wanton Destruction of Wild Birds.

Extract from the Annual Report of the Queensland Society for Prevention of Cruelty:—This is a matter about which the society has been much concerned, because we were aware of the extent to which the cruel destruction of harmless birds took plase, mostly at the hands of thoughtless school boys, and in some cases the sons of parents who subscribe to the society—yet they provide their sons with pea rifles and shanghais to go out shooting birds. Perhaps the mother bird of a nest of fledglings is maimed or killed, leaving the little family to die of starvation.

We have in the past endeavoured to stop or check this by appealing through the schools, but we only met with a small measure of success. Now, however, we are glad to learn that action is being taken by Mr. Bulcock, the Minister for Agriculture, and we are hopeful that before this report is in print, a proclamation will have been issued by the Government making the Greater Brisbane area one big sanctuary. At present there are nearly thirty different sanctuaries, which makes it impossible to check those breaking the law. But when this one sanctuary scheme becomes an accomplished fact, then any person found with a gun, pea rifle, shanghai, &c., within the area, will be committing an offence.

We heartily compliment the Government on its humane action.

Another phase of cruelty is involved in the many instances of trapping and traffic in birds that are purchased by no doubt well-meaning people, and then caged for the rest of their lives. Why do we do it? [The whole of the Greater Brisbane area has since been proclaimed a sanctuary for protected bird life.—ED.]

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

HOUSEKEEPING IN HARD TIMES.

SPEND YOUR MONEY WISELY AND ECONOMICALLY.

(*In writing this we are indebted to a booklet by Dr. Phyllis Cilento and to other kind friends who have made a special study of economical housekeeping. We write with special reference to conditions in Brisbane.*)

THERE are two reasons why so many children are poorly nourished—want of knowledge and want of pence. It is quite possible to give children as much as they want to eat and yet feed them so badly that they cannot be really healthy. These children are thin, undergrown, easily tired, slow at school, constantly suffer from colds and coughs, often develop diseased tonsils and adenoids, and have a poor chance of developing into healthy men and women.

The Right Feeding of Families.

The right feeding of families on relief wages is difficult; yet it is surprising how much can be done by a woman who is a good manager and has some knowledge of the values of foods. Everything depends on the housewife and the care and skill with which she spends the slender stream of shillings and pence which form the family income. It will help her very much if she makes use of the following hints:—

Do not live from hand to mouth. Think out carefully the week's rations of your family—what you will need and what you will pay for it.

Buy the food supplies yourself. Local cash shopping centres are cheap, and tram fares are more than saved by lessened cost and better quality. Watch the market prices and buy what is cheap and in season. Pay cash and you can buy where, how, and when you like.

Buy wisely. It is not the costly foods that are most valuable. The cheaper cuts of meat, if properly cooked, are just as nourishing as the more expensive. Liver, kidneys, heart, and sweetbread are more valuable foods than chops, steaks, and joints, and they are much cheaper.

Choose the fruit and vegetables that are plentiful and cheap. The best vegetables are those that you grow yourself. Even a few lettuces and tomatoes grown in tubs or tins are a great help. On a very small piece of ground you can grow enough vegetables to support a family, and save two or three shillings every week. Lettuces, silver beet, carrots, and tomatoes are the most valuable and easy to grow. If besides these you can grow cabbages, beans, peas, marrows, turnips, parsnips, and onions, you are well off indeed. Every backyard should grow a lemon tree and a few pawpaws, together with a choko vine. This applies specially to Brisbane and the coastal districts from Bundaberg southwards. With water laid-on it is easier, but even without this you can use the bath water, and in good seasons the rain will help you.

Do not waste your money on cooked or tinned foods, biscuits, rusks, or fancy breakfast foods. Wheatmeal is the best breakfast food, oatmeal comes next, and both are inexpensive. Both of them may be used for scones, cakes, and puddings; if flour alone is used, add some large spoonfuls of cooking bran.

The one thing of which you should always buy enough is milk. Every child under six should have one pint of milk daily; from six to fourteen half a pint is the least that can be advised; over fourteen a quarter of a pint should be the minimum.

Though dried skimmed milk is no substitute for milk, it may be used with butter or dripping in puddings. Condensed milk is half sugar and is never economical. Mixed, as it usually is, with much water, it is very poor nourishment.

Instead of puddings, give the children sometimes junket mixed with sliced or shredded uncooked fruit—apples, oranges, pineapple, papaw, tomatoes, &c.

Butter is the most valuable fat. Next to it comes dripping, which is cheaper. You should carefully save your own dripping. This will not be much, and you will probably need to buy some. Margarine is inferior to dripping and costs more.

Use sugar and golden syrup in moderation. Too much of them may possibly satisfy your children's hunger but leave them undernourished and unhealthy for want of better food. Home-made jam (cost of fruit, sugar, and fuel) is much cheaper than bought jam.

It is better to spend a penny or two on carbonate of soda and cream of tartar than to throw away money by buying self-raising flour. Wholemeal bread and flour cost more than they should. We, therefore, advise you to buy cooking bran (1½d. a lb.) to add to porridge, puddings, and scones; or it may be taken simply moistened with milk or water. The daily allowance is two heaped teaspoonfuls for each person. In a family of five 1 lb. should last twenty-five days.

Prepare the right quantities for each day, but never throw away food unless it is bad. "Leftovers" may be used in many ways. Sour milk can be made into scones and saves using cream of tartar. Porridge may be made into milk puddings. Stale bread and scones may be made into trifle, with junket or custard and jam, or they may be baked into rusks, or they may be fried. Crumbs are always useful for cooking. Pineapple peelings make a nice acid drink. Cold potatoes may be sliced for salads, made into soup or into scones. Outside lettuce leaves, turnip tops, and silver beet are as good as spinach. Bones and fishbones and trimmings of bones and fish are good for soup; so also is any water that drains away from cooked vegetables. Pea pods boiled soft and strained are a useful vegetable for soup.

Save fuel by arranging your meals so that several dishes may be cooked at the same time. Remember that raw fruits are better than cooked fruits. Well-washed lettuces with sliced tomatoes or shredded young carrots should sometimes replace cooked vegetables. Cold meat is better than twice-cooked meat (though that is good) if it is fresh, but it must not be kept over twenty-four hours in the summer.

If vegetables are grated or cut up small, they need less cooking.

Next month we will give some economical weekly diet sheets.

IN THE FARM KITCHEN.

PINEAPPLE RECIPES.

Pineapples can be used to give zest and variety to meals which have, perhaps, become a trifle monotonous.

Their valuable dietetic properties are becoming more and more widely recognised, and, as an article of diet for both adults and children, they are rapidly increasing in favour.

Pineapple Plain.

Pineapple served in its own shell is very attractive. Cut off the bottom of the pineapple at the point where the sides begin to narrow downwards, and at the point where the sides begin to narrow upwards cut off the top. Take a very long sharp knife (a saw-knife is best) and detach the whole of the rest of the skin in one piece. Slip it off and cut the pineapple into round slices, without allowing them to fall apart. Stand the shell upright and very carefully replace the slices. Keep any juice, add to it a little liqueur, and serve separately. When shredding pineapple, the easiest way is to cut the pineapple in half, and with a stainless or silver knife chop and shred it within the skin before scooping into a dish. It is thus possible to get every bit of fruit and juice, leaving only the core, skin, and eyes behind.

Pineapple Dessert.

Peel a ripe pineapple and carefully take out the core with a silver knife. Pour into the cavity some sweet white wine and let it stand for twelve hours. Cut in slices and serve with caster sugar.

Pineapple Slices.

Take some peeled and cored pineapple slices and stew them in a thin syrup flavoured with rum. Cut slices of stale plain cake the same size as the pineapple and fry them in butter. Dust over with caster sugar, arrange them alternately on a dish with the pineapple and pour over it all the syrup and serve hot.

Pineapple Cup.

Squeeze the juice from a large pineapple and add to it a breakfastcupful of well-made barley-water and a wineglass of Kirsch. Let it stand for half an hour and add soda-water if liked.

Pineapple Salad.

Mix 1 cup tart chopped pineapple with a shredded grapefruit and half cup chopped nuts or celery. Add fresh or preserved cherries and serve on lettuce with mayonnaise dressing.

Pineapple Soup.

Take 2 tablespoons sago, 1 pint water, 1 stick cinnamon, 1 cupful chopped raisins, sugar to taste, cupful pineapple, juice half lemon, pieces of chopped pineapple. Put the sago in a pint of water and let it cook in a double saucepan with the cinnamon until transparent. Add the chopped and seeded raisins, sugar, pineapple, and lemon juice. Serve in glasses very cold with small pieces of pineapple floating in it. (A delightful dish for luncheon on a hot day.)

Pineapple Cream.

Take a large ripe pineapple, cut it in half, and shred all the pulp. Press half of it through a sieve, add to it the juice from the other half, and make it hot. Dissolve in it ½-oz. gelatine, add 3-oz. caster sugar and the rest of the shredded pineapple. Whip half pint of cream until stiff, and when the pineapple mixture is cool, stir together and keep stirring gently until it begins to set. Pour into a mould.

Pineapple Fritters.

Prepare the pineapple in advance by peeling, coring, and cutting it into medium slices. (The slices may be cut in half or left in rounds.) Sprinkle well with sugar, pour over them a wineglass of brandy if liked and let them stand for three hours. Make a thick batter by putting 6 tablespoons sifted flour into a basin with a pinch of salt, and adding to it yolks of 2 eggs and quarter pint of cold milk. Mix until very smooth, then add the whites of 2 eggs which have been beaten to a stiff froth. Dip each piece of pineapple into the batter and fry in boiling lard until a nice golden brown. Dredge well with caster sugar.

Pineapple Savouries.

(1.) Take a slice of pineapple, one-third of an inch in thickness, peel and core it, and cut into small cubes. Take some salmon, mash it up finely with seasoning and a dash of mayonnaise. Arrange a little on each cube of pineapple, garnish with chopped mint or capers, and place on each piece a toothpick for handling it. Arrange in a lettuce leaf or in paper cases.

(2.) Take cubes of pineapple, as in the previous recipe, dip them in flour seasoned with pepper and salt, and fry them in hot bacon fat. Fry also some narrow strips of bacon, and serve with pineapple on a fried crouton.

Pineapple Cake.

Take a round or square cake-tin and butter it very liberally. Put a thick coating of brown sugar and some more small pieces of butter, then half cup pineapple cut into small pieces. Pour in a plain Madeira cake mixture and cook in the usual way. Turn out when cooked, and, when cold, serve with whipped cream.

Pineapple Snow.

Take a small ripe pineapple, cut in half and shred as directed. Place in a saucepan with half cup sugar, and cook for a few minutes. Thicken with 1 dessert-spoon of arrowroot mixed with a little water. When thick remove from fire, and, when cold, fold in the whites of 2 eggs which have been beaten to a very stiff froth. Place in ice chest to become thoroughly cold and serve with custard made from the yolks of the eggs.

Pineapple Chutney.

Take 4 lb. unripe pineapple (peeled and cut into pieces), 1 lb. sultanas, 1 table-spoon green ginger, 1 oz. garlic, 1 lb. onions, 2 oz. salt, 1 oz. mustard-seed, 2 bottles vinegar, half tin golden syrup. Sprinkle the pineapple with salt overnight, drain, put it into the vinegar, and simmer over the fire for half an hour. Add all the other ingredients except the golden syrup, allow to cook slowly for another hour, add the syrup, and continue to cook for another half hour. Put into small jars and cork down when cold.

Crystallised Pineapple.

Take pineapples which are ripe, but not overripe. Peel them and cut into slices, taking out the core. Weigh the fruit and allow equal weight in sugar. Place in a dish and sprinkle them with part of the sugar. Leave for twenty-four hours, take the juice from the fruit, the remainder of the sugar, and quarter pint water to each pound of sugar. Boil gently for ten minutes, put in the pineapple, and boil two minutes. Turn all into clean dish, leave for two days, then boil the syrup again and pour it over the fruit. Next day boil up the syrup and, once more, when boiling, put in the fruit and boil for five minutes. Let stand again in the syrup for twenty-four hours, then spread on trays to dry, either in the sun or in a cool oven. When partly dry sprinkle with sugar and keep turning until quite dry. Pack between layers of paper.

AN ANT-PROOF DEVICE.

Here is an idea for keeping ants from climbing the legs of the safe, table, &c., in search of food. The device is inexpensively constructed, and when finished will look quite tidy and keep in good working order for a very long time without further

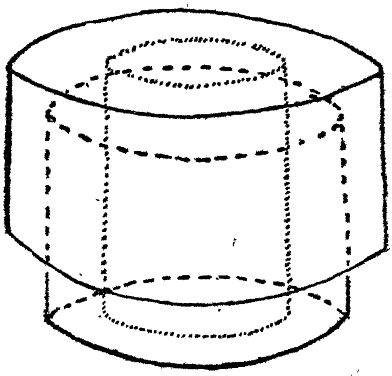


PLATE 222.

attention. The materials required for each preventer are: One round piece of wood 1½ inches in diameter and 2 inches long, one round tin 2½ inches by 1½ inches, one round tin 3½ inches long by 1½ inches deep, a few strong tacks, and a quantity of light cup grease.

The round block of wood must be squarely cut off on each end and is tacked to the bottom of the smaller tin in the centre. There will now be at least half-an-inch clearance all round the block of wood, and it will project half-an-inch above the top of the tin. The grease is to go in the space round the block, but before filling in the grease it is advisable to solder the heads of the tacks over to prevent leakage, which may occur on a hot day. The larger tin is fitted over the top of the wood and tacked in place. This top tin could be left off, but without it the baffler would not look finished, and would not be as effective, for the top cover keeps the dust from settling on the grease. The measurements given above are ideal, but may be varied to suit the materials at hand; but at all times there should be sufficient clearance so that the ants cannot bridge across.

A BUTTER COOLER.

A useful butter cooler to hang on a verandah can be made from a kerosene tin, cut as shown in Fig. 1 in the illustration, allowing 2 in. for the roll. On one side allow the full height of the tin; on the opposite side cut to 5 in., and slope the remaining sides. Place a ¼-in. iron rod along the edge, grip with a footprint wrench or pliers, and roll downwards till the dotted line is reached (BB in Fig. 2). Treat

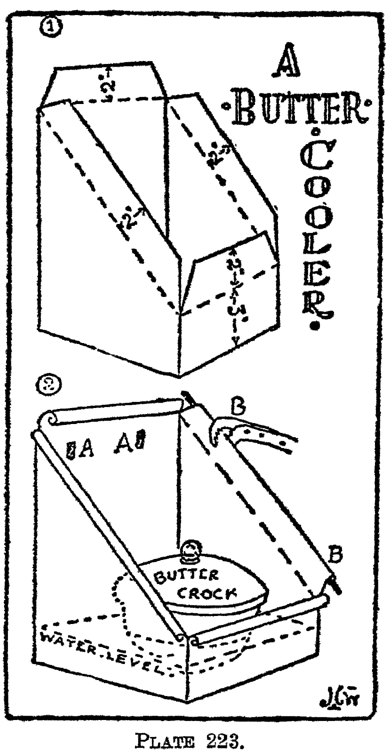


Plate 223.

all sides the same except the back; roll that inwards so that the tin will lie flat against the wall, then punch two slots in the back (AA, Fig. 2) with a screwdriver or cold chisel, about ½-in. wide by 1¼ in. high. Scribe to the wall with a pencil, then screw two square-shouldered cup hoops on the wall and hang on. Put in about 2 in. of water; put in the butter crock covered with a damp cloth. If hung in a draughty place the butter will keep cool and firm on the hottest days, and it only needs unhooking to clean and change water.

FERTILIZERS FOR THE HOME GARDEN.

FOR the maintenance of fertility the city gardener has to place his chief dependence on chemical fertilizers, and the grower who lacks information as to the plant food content of his soil, and who desires to grow a wide range of crops of whose requirements he knows little, should play safe by using a high-grade "complete" fertilizer, and give a liberal application. Though he applies more than the plants actually require, the increased cost is so slight that the assurance of having enough is worth the additional expense.

A complete fertilizer is one supplying nitrogen, phosphorus, and potash in forms readily available to plants. A generally applicable complete fertilizer for home garden use consists of a mixture of dried blood, superphosphate and sulphate or chloride of potash. These substances in the proportions by weight of 3, 4, and 1 respectively give a 5-11-6 fertilizer, or one containing 5 per cent. nitrogen, 11 per cent. phosphoric acid, and 6 per cent. oxide of potash. On light-textured soils potash could be increased by using the same substances in the proportions of 2, 3, and 1, when a 4-11-8 fertilizer would be obtained.

Dried blood has many advantages as a source of nitrogen. It does not damage seeds or seedling roots, becomes available when the root system is developing, and is therefore not lost. It is a useful basal form of nitrogen application, carrying plants up to the stage where it may be advantageous to apply forcing soluble nitrogenous fertilizers.

Sulphate of ammonia may be used in place of dried blood in the complete mixture, but should be used in two-thirds the quantity. The use of sulphate of ammonia results in loss of lime from soils, and in time develops strong acidity. These harmful effects are easily overcome by liming, but it is not advisable to use this fertilizer on acid, lime-deficient soils.

The tendency in home gardens is to use quantities of manure without the application of potash and phosphate, and results in a bad nutrient balance, which accounts for the frequent reports of plants producing excessive vegetative growth, with poor flower, fruit, or tuber production. Under such conditions the addition of a mixture of four parts of superphosphate and one of sulphate or chloride of potash would result in a better nutrient balance.

For crops such as lettuce, cauliflower, cabbage, Brussels sprouts, spinach, and celery, where vigorous growth must be maintained, liquid fertilizers can be applied when the plants are well established. The following flowers, provided a complete fertilizer has been used initially, have been found to respond to nitrogenous top-dressing:—Dahlia, chrysanthemum, calendula, Iceland poppy, sweet pea, primula, &c. The soil should be moist before the application of liquid fertilizers.

The most efficient forms of nitrogen for liquid applications are nitrate of potash, nitrate of soda, or a mixture of these salts, and nitrate of lime. Sulphate of ammonia, phosphate of ammonia, or a complete liquid fertilizer consisting of nitrate of potash and superphosphate may be used. These substances are soluble in water (superphosphate will leave a considerable residue) and can be dissolved at the rate of 1 to 2 oz. per gallon, and the solution run along the rows from a water-can with the sprinkler removed, or applied with a measure in the case of larger, spaced plants.

If the liquid comes in contact with the leaves, these may be hosed down after the application has been made, to obviate the possibility of injury.

The practice of broadcasting fertilizers is wasteful, since much of it will not come within the absorbing range of roots. When seeds are planted in drills, these should be opened up several inches broad at the bottom and from 1 to 3 inches deeper than the seed is to be placed. The fertilizer is then distributed along the bottom of the row, at the rate of an ounce or two to the yard, the drill filled in to the desired depth, and the planting made.

With large growing plants that are spaced, such as tomatoes, cabbages, and potatoes, a hole a foot in diameter and several inches deep can be made with a spade, and a small handful of fertilizer scattered in the hole before filling in and planting above the fertilizer. Fertilizers for potatoes should be slightly below and in a ring about the tuber, rather than directly beneath it.

Orchard Notes for November.

THE COASTAL DISTRICTS.

NOVEMBER is somewhat of a slack month for fruit in the coastal districts, as the citrus crop, excepting a few Valencia Late oranges, off-season lemons, and a few lines, is over. Pineapples are also scarce, as the late spring crop is finished, and there are only comparatively few off-season fruits ripening. The main summer crop of fruit in the principal producing districts is only in the flowering stage, though that in the more tropical parts is ready for marketing. It is also a slack month for bananas, as the summer fruit is not yet fully developed, and the bunches that make their appearance are usually poor. They have been slow in developing on account of the comparatively cool weather of winter and early spring, when the suckers were more or less at a standstill. Young suckers should, however, be making vigorous growth now, and the plantation will require constant attention to prevent the stools being overcrowded with too many suckers. Keep the land well worked and free from weeds of all kinds, as good growth now means good bunches in the autumn and early winter. Where there is a danger of the soil washing badly with heavy rain, rows of Mauritius, velvet, or other suitable beans should be planted at right angles to the fall of the land, as the growth they make will tend to hold the soil, and thus save any from being washed away. When planting beans of any kind, either to prevent washing or for green manuring, don't forget to manure them, as thereby you will get a much greater yield, and as none of the manure is removed from the soil, as the crop is allowed to lie and rot on the ground, it is all made use of eventually by the permanent crop.

A good all-round manure for a bean crop is a mixture of 1 cwt. of sulphate of potash and 4 cwt. of basic superphosphate or finely ground phosphatic rock to the acre, and if the soil is deficient in lime a dressing of not less than half a ton to the acre will be found very beneficial, as all leguminous plants require lime to yield their maximum return both of haulm and pulse. The pineapple plantations require to be kept in a state of thorough tilth, and no weeds must on any account be allowed to grow. If blady grass makes its appearance it must be stamped out, as once it gets established in the rows it is only a short time before it takes control, and the plantation is ruined, so that it can only be brought back into profit by taking out the pines, killing the blady grass, and, after thoroughly and deeply working the land, manuring it and replanting.

The planting of pineapples and bananas can be continued throughout the month, taking care to see that the land is properly prepared and that the advice given in previous monthly notes is followed. Young papaw plants that have been raised in the seed bed can be set out now, as also can young passion fruit. Citrus orchards require to be well looked after; the ground must be kept in a state of thorough tilth, and if the trees show the slightest sign of distress, owing to lack of moisture in the soil, they must be given a thorough irrigation if water is available for this purpose. The trees should be carefully examined from time to time, so as to note when young scale insects of any kind are hatching out, and when this is noted they should be sprayed with a weak emulsion of a miscible oil consisting of one part of oil in forty parts of emulsion, as this is quite strong enough to kill any young scales before they develop their protective covering. As stated in these notes previously, no oil sprays should be used when the trees are suffering from lack of moisture, as they are then likely to do more damage than good to citrus trees. If scale insects are very bad, and it is important that the trees are sprayed, a weak lime-sulphur spray, or even a soap and tobacco or weak resin wash, will kill the young scales as they hatch out. In the earlier districts a keen lookout must be kept for the first appearance of the mites, which are the direct cause of the darkening of the skin of the fruit known as "Maori." The first indication of the trouble is that when the sun is shining on the young fruit it appears to be covered with a grey dust, and if the fruit is examined with a good lens, it will be seen to be covered with large numbers of small yellowish slug-like insects which are living on the skin. Spraying with sodium of potassium sulphide washes, as recommended by the Department, or with a weak solution of lime-sulphur, will destroy these insects and prevent the fruit from turning black. Borers of all kinds should be looked for and destroyed wherever found. Water sprouts, if not already removed, should be cut away. Vines will require careful attention, and the vineyard should be kept in a state of thorough cultivation. Spraying for downy mildew and black spot should be continued, if necessary, as well as sulphuring to prevent oidium.

Fruit fly must be systematically fought whenever seen, and special care must be taken to gather and destroy any early ripening peaches or other fruit that may be

infested. If this is done systematically by all growers, as provided by the Diseases in Plants Acts, there will be many less flies to attack the later crops of mangoes and other fruits.

Leaf-eating insects of all kinds should be systematically fought wherever seen, by spraying with arsenate of lead, and potatoes and tomatoes should be sprayed with a combined spray consisting of Bordeaux or Burgundy mixture and arsenate of lead, so that diseases such as early blight and Irish blight may be prevented and leaf-eating insects, which frequently cause very heavy losses to these crops, be destroyed.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

KEEP the orchards and vineyards in a thorough state of cultivation, so as to keep down all weed growth and conserve moisture in the soil. This is important, as if a long spell of dry weather sets in, the crop of summer fruit will suffer severely from the lack of moisture. Citrus trees should be irrigated where necessary, and the land kept in a state of perfect tilth. Spraying for codlin moth should be continued, and all pip fruit trees must be bandaged at the beginning of the month; further, the bandages must be examined at frequent intervals and all larvæ contained in them destroyed. The neglect to spray thoroughly and to attend to the bandages properly is responsible for the increase in this serious pest in the Granite Belt, and growers are warned that they must pay more attention to the destruction of this pest if they wish to grow pip fruit profitably. Fruit fly may make its appearance in the cherry crop; if so, every effort should be made to stamp out the infestation at once, as, unless this is done, and if the fly is allowed to breed unchecked, the later ripening crops of plums, peaches, apples, pears, apricots, and Japanese plums are bound to become more or less badly infested. Combined action must be taken to combat this the most serious pest of the Granite Belt, and growers must realise that, unless they take this action and see that careless growers do not breed the fly wholesale, they will never keep it in check, and it will always be a very heavy tax on their industry. Rutherglen bug is another serious pest in this district, and is propagated by the million by careless orchardists. The best remedy for this pest is to keep the orchard clean and free from weeds. Brown rot in fruit should be watched for carefully, and, on its first appearance in a district, all ripening fruit should be sprayed with the sodium sulphide wash.

All kinds of leaf-eating insects should be kept in check by spraying with arsenate of lead, and all grape vines, potatoes, and tomatoes should be kept sprayed with Bordeaux or Burgundy mixture, the former for black spot and downy mildew, and the latter for early and late (Irish) blight.

Farm Notes for November.

FIELD.—Farmers are commencing to realise that quick-maturing wheats which possess a degree of rust resistance are more dependable than the slow-growing and often rust-susceptible kinds, which are gradually giving place to these and mid-season varieties.

Growers are advised to make every preparation to work up the surface of the ground immediately after the removal of their crops, so that the soil may be put into good condition to receive any rain which falls, the conservation of which is the best guarantee for the success of the next succeeding crop. Such initial preparation also encourages the early growth of all foreign and weed seeds, and permits of their eradication by the implements used to produce the desired soil mulch. In such manner paddocks are kept clean and the purity of crops is maintained. The careful preparation of areas intended for maize-planting cannot be too strongly impressed upon growers. Deep and thorough ploughing, followed by cross-ploughing and subsequent cultivation of the soil, must precede sowing if success would be attained; and all efforts must be concentrated to obtain a good surface mulch. Failure to follow up the subsequent sowings by harrowing prior to the appearance of the young plant conduces to weed growths and very often entails, by neglect of this operation, subsequent hand-hoeing between the plants in the drills. Harrowing should be discontinued before the plant breaks through the surface, otherwise damage will accrue to the tender shoots of the young plants. When the young maize plant has hardened up it may, with advantage, be lightly harrowed in the direction of the drills, but such practice must discontinue once the plant has attained a height

of 6 inches. Close cultivation by inter-row cultivation implements is necessary after every shower to conserve moisture and to prevent weed growth, care being taken to ensure each cultivation being shallower than the preceding one, and so prevent damage to the root system of the plant, which is extensive. Inter-row cultivation should cease with the advent of the cob on the plant; and, if proper attention has been given to the crop, it should, at this period, be unnecessary. Where crops are planted on the check-row principle, inter-row cultivation is facilitated, and more even crops result.

The French millets (red and white), owing to their rapid maturing qualities, form excellent intermediate or supplementary crops, and are suitable for present sowing. Their value for fodder and seed purposes is worthy of more general recognition at the hands of the average farmer.

Past dry periods have impressed upon us the necessity of providing during good seasons against the return of less favourable ones, and in this connection the cultivation of quick-growing fodder plants appeals to us. Many varieties of useful classes of fodder can be cultivated over a large portion of this State; chief of which, perhaps, are the sorghum family for grain and fodder purposes. Of the latter, Sudan grass has much to commend it, and is fast becoming one of the most favoured by stockowners. Grain sorghums, of which Feterita, Red Kaffir, and the various Milos are examples, should occupy a more prominent position for purposes of horse and pig feeding, and are particularly suited to those localities which are unsuitable for maize production. Some varieties of sorghums have strong frost-resisting qualities, and lend themselves to those localities where provision for some form of succulent fodder is necessary during the winter months.

Crown Land for Grazing Selection.

WEELAMURRA RESUMPTION.

CUNNAMULLA LAND AGENT'S DISTRICT.

THE eastern end of the holding, together with an adjoining surrendered selection, comprising in all about 29,000 acres of good mulga country, will be opened for Grazing Homestead selection at the Land Office, Cunnamulla, on Monday, 12th November.

The term of lease will be twenty-eight years, and the annual rental 2d. per acre for the first seven years of the term.

The area is situated about fifty-five miles south-easterly from Cunnamulla, and comprises partly nice open plains, coolibah, gilgai, and sandy mulga and pine country interspersed with box. Good herbage is available in favourable seasons, and the country is fattening.

The country is well watered by bore drains from an adjoining selection, and present supplies are sufficient.

The improvements, embracing homestead and outbuildings, fencing, yards, and bore drains are valued at £1,034.

The selection will require to be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

The selection must be enclosed with a rabbit-proof netting fence during the first three years of the term.

Free lithographs and full particulars may be obtained from the Land Agent, Cunnamulla; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence Bureaux, Sydney and Melbourne.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF AUGUST, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING AUGUST, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Aug.	No. of Years' Records.	Aug., 1934.	Aug., 1933.
North Coast.	In.		In.	In.
Atherton	0·89	33	0·29	2·71
Cairns	1·75	52	0·53	2·77
Cardwell	1·25	62	1·96	1·83
Cooktown	1·23	58	0·23	1·02
Herberton	0·65	48	0·37	1·22
Ingham	1·43	42	1·29	1·93
Innisfail	4·93	53	1·56	6·18
Mossman Mill ..	1·42	21	0·87	4·30
Townsville	0·52	63	0·27	1·84
Central Coast.				
Ayr	0·58	47	0·22	1·88
Bowen	0·66	63	0·59	2·18
Charters Towers ..	0·54	52	0·62	0·37
Mackay	1·05	63	0·42	1·93
Proserpine	1·36	31	1·01	3·87
St. Lawrence ..	0·82	63	..	0·58
South Coast.				
Biggenden	1·09	35	1·31	2·41
Bundaberg	1·28	51	1·64	1·58
Brisbane	1·99	83	1·26	0·90
Caboolture	1·53	47	1·63	1·20
Childers	1·21	39	1·59	1·69
Crohamhurst ..	2·18	41	1·20	1·40
Esk	1·48	47	1·56	0·96
Gayndah	1·15	63	1·80	1·46
Gympie	1·72	64	1·42	1·25
Kilkivan	1·45	55	0·98	1·45
Maryborough ..	1·70	63	2·02	1·80
Nambour	1·83	38	1·59	1·37
Nanango	1·32	52	2·23	1·58
Rockhampton ..	0·84	63	0·46	0·88
Woodford	1·69	47	0·47	1·40

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Aug.	No. of Years' Records.	Aug., 1934.	Aug., 1933.
Central Highlands.	In.		In.	In.
Clermont	0·70	63	..	0 66
Gindie	0 66	35	..	1 02
Springsure ..	1·06	65	0 16	1·59
Darling Downs.				
Dalby	1·20	64	0·95	1·31
Emu Vale ..	1·10	38	0·51	0·60
Hermitage ..	1·19	28	..	0·38
Jimbour	1·16	46	1·23	1·24
Miles	1·13	49	0·26	1·52
Stanthorpe	1·77	61	2·46	1·15
Toowoomba ..	1·65	62	1·40	1·50
Warwick	1·46	69	0·85	0·61
Maranoa.				
Roma	0·93	60	0·07	1·21
State Farms, &c.				
Bungeworgorai ..	0·76	20	0·21	0·98
Gatton College ..	1·13	35	1·01	0·73
Kairi	0·94	20	0·30	2·45
Mackay Sugar Experiment Station	0·90	37	0·27	1·66

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—AUGUST, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·99	79	62	82	18, 19, 20, 24, 25, 27, 28, 29,	51	14	23	2
Herberton	..	73	49	80	15	35	7	37	2
Rockhampton	30·12	77	52	84	15	40	8	46	5
Brisbane	30·13	70	51	77	14	41	5	126	4
Darling Downs.									
Dalby	30·13	68	42	78	28	30	5, 7	95	3
Stanthorpe	..	60	36	72	28	22	6	246	11
Toowoomba	..	63	43	72	14	32	7, 8	140	8
Mid-Interior.									
Georgetown	30·02	84	55	91	26	44	7	Nil	..
Longreach	30·12	76	45	90	26	35	6	Nil	..
Mitchell	30·12	71	40	82	26	28	6	75	2
Western.									
Burketown	30·05	82	55	90	18, 19	48	14, 23	Nil	..
Boulia	30·11	76	47	94	26	38	23	9	2
Thargomindah	30·10	69	46	89	27	37	2, 4, 6	99	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	October, 1934.		November, 1934.		MOONRISE. Oct., 1934.	MOONRISE. Nov. 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5·33	5·51	5·8	6·9	12·50	1·16
2	5·32	5·52	5·2	6·10	1·35	1·46
3	5·31	5·53	5·2	6·11	2·13	2·15
4	5·29	5·54	5·1	6·11	2·45	2·45
5	5 28	5·55	5·0	6·12	3·17	3·16
6	5·27	5·56	5·0	6·12	3·46	3·49
7	5·26	5·56	4·59	6·13	4·15	4·26
8	5·25	5·57	4·58	6·14	4·46	5·8
9	5·24	5·57	4·57	6·15	5·17	5·58
10	5·23	5·57	4·56	6·16	5·31	6·56
11	5 22	5·58	4·56	6·16	6·30	8 0
12	5·21	5·58	4·55	6·17	7·14	9·5
13	5·20	5·58	4·55	6·18	8·6	10·14
14	5·19	5·59	4·54	6·19	9·4	11·19
						p.m.
15	5·18	5·59	4·54	6·20	10·9	12·23
16	5·17	5·59	4·53	6·21	11·13	1·25
					p.m.	
17	5·16	6·0	4·52	6·21	12·21	2·26
18	5·15	6·0	4·52	6·22	1 28	3·28
19	5·14	6·1	4·52	6·23	2·32	4·30
20	5·12	6·2	4·51	6·24	3·38	5·34
21	5·11	6·2	4·51	6·25	4·38	6·35
22	5·10	6·3	4·51	6·26	5·40	7·35
23	5·9	6·3	4·50	6·27	6·46	8·30
24	5·8	6·4	4·50	6·28	7·52	9·20
25	5·7	6·5	4·50	6·28	8·59	10·4
26	5·6	6·6	4·50	6·29	9·48	10·41
27	5·6	6·6	4·50	6 29	10·42	11·16
28	5·5	6·7	4·49	6·30	11·28	11·47
29	5.4	6.7	4·49	6·30	a.m.	a.m.
30	5·4	6·8	4·49	6 31	12·10	12·14
31	5·3	6·9			12·45	

Phases of the Moon, Occultations, &c.

9 Oct.,	●	New Moon	1 5 a.m.
16 „	☾	First Quarter	5 29 a.m.
23 „	○	Full Moon	1 1 a.m.
30 „	☽	Last Quarter	6 22 p.m.

Apogee, 3rd October, at 7.54 a.m.
Perigee, 19th October, at 12.18 a.m.
Apogee, 31st October, at 3.24 a.m.

When the Sun sets on the 10th Mercury, being at its greatest eastern elongation, 25 degrees, will be well above the western horizon (which it will reach 1 hour 43 minutes later) at a point 11½ degree further south at 4 o'clock next morning, Mercury will be only 2 degrees north of the Moon, so that when the Moon rises 2½ hours later the distance between the two will be between 3 and 4 degrees.

Jupiter, which may be said to have been an evening star, in Virgo, since early in April, will be lost to sight in October, as it will be in a line with the Sun on the 27th. It will then be on the far side of its orbit and at a distance of more than 550 million miles from the Earth.

Saturn, which may also be said to have been an evening star since June, keeping very near the border line of Capricornus and Aquarius, but with a slight retrograde motion, from Right Ascension 22·3 to 21·37, will become stationary on the 27th, and then again move very slowly eastward, without, however, getting so far as it was in June.

The brilliant planets Venus and Jupiter will be in very close conjunction on 2nd November, when the apparent distance between them will be only 3 minutes. This would form a very interesting spectacle if it were not that they will seem to be so close to the Sun as to be within 3 degrees of it.

The path of the Moon will be—in Gemini on the 2nd and 3rd of October; in Leo from 3rd to 6th; in Virgo from 7th to 10th; in Libra on the 11th; in Scorpio 12th; in Orphiucus 13th; in Sagittarius 14th to 16th; in Capricornus 16th to 18th; in Aquarius 18th to 20th; in Pisces 20th to 22nd; in Aries 23rd and 24th; in Taurus 25th and 26th; in Gemini 27th to 29th; in Cancer 30th, and in Leo on the 31st.

Mercury sets at 7.39 p.m., 1 hour 48 minutes after the Sun on the 1st; on the 15th it sets at 7.44 p.m., 1 hour 55 minutes after it.

Venus rises only 32 minutes beforethe Sun on the 1st, and only 20 minutes before it on the 15th.

Mars rises at 3.19 a.m. on the 1st, and at 2.51 a.m. on the 15th; Jupiter sets at 7.24 p.m. on the 1st, and at 6.43 p.m. on the 15th. Saturn sets at 3.35 a.m. on the 1st, and at 2.38 a.m. on the 15th.

7 Nov.	●	New Moon	2 44 p.m
14 „	☾	First Quarter	12 39 p.m.
21 „	○	Full Moon	2 26 p.m.
29 „	☽	Last Quarter	3 59 p.m.

Perigee, 12th November, at 10.54 p.m.
Apogee, 28th November, at 12.18 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

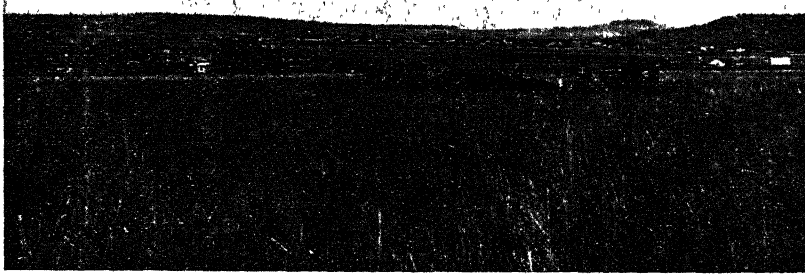
The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

QUEENSLAND AGRICULTURAL JOURNAL



VOL. XLII. 1 NOVEMBER, 1934. PART 5.

Event and Comment.

Development of Agriculture in Queensland.

IN the course of his reply in the debate on Supply in the Legislative Assembly, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said—

> Perhaps the most gratifying feature of the protracted debate on this vote is the eulogy that has been paid by all hon. members on both sides of the Committee to the very excellent staff in the Department of Agriculture and Stock. As the Minister in charge of that department, I very heartily corroborate everything that has been said. Of course, there is nothing spectacular about the work that our officers are doing. The ordinary layman does not realise the research work that is being proceeded with, for instance. Such words as plant pathologist, entomologist, and agrostologist are to them but names. The men engaged in this particular phase of research are modesty personified, certainly not through any lack of capacity. They are infrequently brought in contact with the public. They are men of a calibre which ranks very highly in the scientific agricultural world of Australia. They are men of whom Queensland may well be proud. There is certainly a more generous recognition to-day of the work of these men in Queensland than perhaps was ever the case before. That corresponds with the alteration that is taking place in the public outlook in regard to primary production. There is not a member of this

Committee who does not remember the time when the average primary producer was referred to in such terms as "cocky," "clodhopper," "wayback," and "rustic." Terms of that description carry some suggestion of a sneer, but fortunately they are falling into disuse. The economic factors of our national life are causing the public generally to view the farmer in his proper perspective, and while we know that that attitude has had little association with the social phases of agriculture, as a department, yet it is to the material good of the whole of the community that this change has taken place.

I have detected a new note creeping into the debate on this occasion, a note that I welcome, a note that finds a ready response in my own mind, that note being that with but few exceptions there is a more generous recognition on the part of members of the value of science in agriculture. Two hon. members suggested that the development of agriculture to-day was entirely a scientific matter. I agree, because if we review the question generally we find that practically every country in the world that has effected a progressive agricultural policy has solved the cultural problem within its own territory. The main problem is not, therefore, one of production, but of distribution. But associated with that question of production is always the question of the reduction of overhead expenditure by the application of new methods. It is true that the old maxim that was generally accepted, unfortunately, by the farming community a generation or so ago, "What was good enough for my father is good enough for me," has now been reversed, so that the average young progressive farmer realises the dependence on science of agriculture, the alliance between cultural operations and economic facts as apart from economic theories. These things have been recognised by the younger generation, who realise that agriculture will not reach its proper social, political, or economic plane until such time as there is a recognition by all sections of the community of their interdependence. The eulogy that has been accorded to the science officers of my department is very gratifying.

Wood Taint in Butter.

REFERRING to the question of wood taint which was raised in the course of the debate, Mr. Bulcock said:—

Quite frequently Queensland butter has been prejudiced in London, not in consequence of the actual incidence of wood taint, but because of the suggestion that it is there. It is doubtful whether wood taint has ever been a problem so far as Queensland butter overseas is concerned; but it is true that implication has frequently been made, and the suggestion that Queensland butters have wood taint is the reason why this product has not succeeded as well on the London market as it would have succeeded had that not been the case. The Commonwealth Government insist on all butter-boxes being sprayed. The matter is beyond our control. I believe the dairying industry generally is antagonistic to this Commonwealth regulation; but the Commonwealth controls exports, and so long as the Commonwealth controls exports—and that, of course, will be as long as there is a Commonwealth—then we shall have to subscribe to the regulations laid down. If we do not agree with the principle, we at least have to acquiesce in it.

Pasture Improvement.

MR. Bulcock then went on to speak of the work of his department in pasture improvement, and remarked:—

The hon. member for Cooroora (Mr. Harry F. Walker) raised the question of pasture improvement. Personally, if I were asked what I could eliminate from my department and if there had to be a progressive elimination, the last thing eliminated would be our work of pasture improvement. At this juncture pasture improvement is the most important work upon which we are engaged. It means, of course, the adaptation of grasses to different soils and climatic conditions. It means a more extensive testing over that long coastline that we have, and it means an intensive search for economic grasses over this area. The hon. member for Cooroora will be gratified to know that our pasture experimental work is guided by a very excellent pasture experimental committee embracing not only officers of the department but also experienced men recruited from outside the department to assist us by their guidance and counsel, and that it enlists also the active co-operation of progressive farmers throughout the State. These instruments are being used for an intensive and vigorous pasture improvement policy. We have pasture improvement work in progress at Daintree, the most northern point in this State where dairying is engaged in. I am assured that Daintree, which is within the tropics, is the closest centre to the equator in the world where dairying is done. That alone is justification for embarking on experiments in that particular locality. If we examine the needs of every locality we find that each has some problems peculiar to itself. These problems have to be examined.

Departmental Literature.

COMMENTING on further favourable criticism of his department, Mr. Bulcock said:—

A good deal of reference has been made during the course of this debate to the "Queensland Agricultural Journal" and its place in the agricultural literature—I use that word advisedly—of our State. Queensland has new problems to face. Differences in climatic conditions, rainfall, and soil types are to be found in different localities. Therefore, we have had to evolve our own literature in connection with all branches of primary production. How well that evolution has been directed and what loyal support has been given by officers of the Department of Agriculture have been evidenced by the favourable tributes that have been paid to the editor of the journal and the staff who have contributed its articles; but I think that it will be agreed that there is one thing that is missing in the agricultural literature of our State. It is true that Ministers of all political parties have recognised the value of pamphleteering; but, after all, that has only a limited value; pamphlets go out of print. We have no classical productions on agricultural possibilities and agricultural processes in our State. I am sure hon. members generally will be pleased to hear that the officers of my department at the present time are compiling an agricultural handbook similar to the agricultural handbook published, I think, in every other State in the Commonwealth, and a handbook that will have special reference to Queensland conditions and will be an invaluable guide to farmers who require an immediate answer to the more perplexing questions with which they are confronted.

The Importance of Tobacco Mosaic.

By L. F. MANDELSON, B.Sc.Agr., Assistant Plant Pathologist.

MOSAIC is a common disease of tobacco wherever it is grown, and no doubt the the characteristic mottled effect of leaves of diseased plants is familiar to most tobacco growers in Queensland. It has been the experience in the past in other countries, and the same tendency is already noticeable in Queensland, that the true importance of this disease is not realised. This is particularly the case when new areas are opened up for tobacco production, as in Rhodesia[2] and in Queensland. Under such conditions inexperienced growers tend to regard this disease merely as an interesting abnormality and fail to realise that, under certain circumstances, it may considerably reduce the market value as well as yield.

Tobacco mosaic has been intensively studied since 1885, when Mayer first discovered that it was a transmissible disease. A considerable amount of this work has been of a fundamental nature since mosaic, which is a virus disease, was the first of this important group of animal and plant diseases to be studied. Many practical aspects of mosaic have also been investigated since its discovery because of its importance as a tobacco disease. Consequently, there is no great need at the present time for original research in Queensland into this well-known trouble. However, it is essential, at this stage of the development of the tobacco industry, that the potential dangers of mosaic should be stressed, and that growers should be made familiar with some of its more important aspects, and with control measures which have given satisfactory results in other countries.

The object of this article is to discuss these various points. Its preparation has been prompted by the fact that some rather striking photographs have just been obtained which appropriately illustrate the harmful effects of mosaic infection. The photographs are of plants used in a recent successful glasshouse infection experiment, and were obtained by the kind co-operation of Messrs. W. J. Sanderson and A. A. Salmon, of the Photographic Branch of the Department of Agriculture and Stock.

Symptoms of Mosaic.

The most obvious symptom of the disease is the characteristic mottling with dark and light green areas irregularly distributed over the leaf surfaces, as is well illustrated in Plate 224. Since it is only leaves which are developed subsequent to infection which show these markings, it is on leaves produced on the upper portion of the plant, or on sucker growth, that these symptoms are most frequently observed. The irregular distribution of the green colouring matter of the leaf blades is associated with uneven growth and consequent buckling and distortion of the leaves. The shape of affected leaves may be quite irregular, varying from long narrow leaves only slightly wider than the mid-rib to leaves of abnormal width and irregular outline. These abnormalities may be observed in Plate 225. Affected leaves are usually thicker and more brittle than normal leaves. Spotting, which persists in the cured leaf, is frequently associated with mosaic mottling.

Symptoms which are sometimes less obvious are dwarfing of the plants, reduction in size of individual leaves with consequent loss of weight, and delayed maturity. These symptoms of mosaic are illustrated

PLATE 224.
Tobacco leaf showing characteristic mottling of mosaic infection.

in Plates 225 and 226. These show healthy plants and plants which were artificially infected when very young with mosaic obtained from diseased leaves collected more than a year previously. Both healthy and diseased plants in each photograph are the same age. It will be noted that five weeks from the time of inoculation the young diseased plants shown in Plate 225, were considerably stunted and distorted. Three months after inoculation an even greater contrast was evident, as shown in Plate 226. This picture clearly shows how mosaic delays maturity. It will be noted also that the diseased plant, besides being much shorter, has developed leaves which are distorted and much smaller than corresponding leaves of the healthy plant.

The severity of mosaic symptoms, and the losses caused by the disease, depend on the age of the plants when infection occurs. The younger the plants when infected the more harmful will be the ultimate results. This infection experiment gives some idea of how harmful these results may be when plants are infected at an early stage.

Furthermore, careful observations in America have recently indicated that mosaic infection not only reduces the yield but also reduces the quality of the cured leaf. Such leaf is uneven, and hence difficult to grade, and its colour is adversely affected as it tends to be dark or to have a greenish cast.

Effect on Yield and Quality.

This important aspect of mosaic disease has been investigated in regard to various types of tobacco in the United States during the past six or seven years.

In 1927 Valleau and Johnson,[5] working with White Burley tobacco in Kentucky, investigated the effect of inoculating plants when being set out in the field and also at topping time. After curing, the leaves were graded and their value estimated by a commercial warehouse. The results showed that when infection occurred at setting-out time, the leaf, as compared with that from healthy plots, was 3 or 4 inches shorter, the yield was reduced by approximately a third (33 per cent.), and the value by two-fifths (43·1 per cent.), on a given weight of leaf. Reference to Plate 226 suggests that the yield might well be reduced by a third under these conditions. The reduction in value per acre was estimated at 61·7 per cent. When plants were not inoculated until topping there was found to be no reduction in yield, but the value of the crop was reduced by approximately a quarter (25·1 per cent.).

McMurtrey[4] reported in 1928 experiments covering a three-year period with Maryland tobacco, which also indicated that both the yield and quality of the crop could be very adversely affected by mosaic, especially when infection occurred shortly after transplanting. In his experiments plants were inoculated either on setting out, one month later, or at topping. Results indicated that inoculation at transplanting time reduced the yield by a third (33 to 35 per cent.), and the gross value of the crop per acre by more than a half (55 per cent.). The damage was almost as severe when plants were inoculated a month after transplanting. When plants were inoculated at topping time the yield was not significantly reduced, but the quality of the crop was appreciably lowered.

As recently as 1933 Wolf and Moss[7] reported a similar investigation extending over two seasons with flue-cured tobacco in North Carolina.

PLATE 225.

Tobacco seedlings on 23rd August. Healthy plant on left, mosaic-infected plant on right. The latter was artificially inoculated with mosaic virus on 17th July. Note stunting, distortion, and blistering of leaves.

Their experiments confirmed those carried out with other types of tobacco, which showed that mosaic adversely affects both yield and quality. It was found that—

(*a*) When plants were inoculated at transplanting the yield decreased by approximately a third (31·4 per cent.), and the value per acre by a half (54·6 per cent.);

(*b*) When inoculated a month after transplanting the reduction in yield and value was almost as great (30·1 per cent. and 42·1 per cent., respectively); and

(*c*) When inoculation was postponed until topping the yield was decreased by about a sixth (17·2 per cent.), and the value by almost a quarter (23·8 per cent.).

They observed that mosaic was rarely as severe under natural conditions in North Carolina as in (*a*) or (*b*) of the above experiment, but sufficient mosaic may be present in crops to cause losses in excess of those produced when crops were artificially inoculated at topping.

So far under Queensland conditions mosaic has not been observed to be very general prior to topping, except in some individual crops. After topping, however, it may be very generally distributed, particularly in certain districts, such as Bowen. As yet no carefully controlled experiments have been carried out to estimate the actual decrease in yield in Queensland, but judging from those discussed above the total losses are probably much greater than most growers would imagine.

The Nature and Dissemination of Mosaic Disease.

Mosaic is a virus disease. That is to say, it belongs to a group of extremely infectious diseases which are not caused by any organism that can be definitely demonstrated. Mosaic may be produced by the sap from a diseased plant being introduced into a healthy plant, even though the sap has been passed through a filter so fine as to prevent the passage of germs or bacteria. Consequently, the disease is readily transmitted by handling during various cultural operations and by sucking insects. In this connection it is interesting to note that mosaic is more prevalent in Maryland[4] than in most of the tobacco areas of America, and this is probably due to the fact that there the previous season's crop is usually on the farm while the new crop is growing. Under such conditions workmen who grade tobacco and then handle the growing crop are apt to introduce the disease by carrying infection from one to the other.

Mosaic may affect many other plants beside tobacco. In fact, recent investigation[1] has shown that the host range of this disease now includes no less than twenty-nine species of families other than the Solanaceæ, the family to which tobacco belongs. Consequently, tobacco may become affected by infection being carried to it from one of several crop plants and weeds. For instance, tomato plants are frequently affected with mosaic, and so quite possibly the unusual prevalence of mosaic on tobacco in the Bowen district may be associated with the extensive cultivation of tomatoes in that area.

Mosaic usually originates from the seed-bed. Should one or two seedlings be affected and no precautions taken many other plants will eventually become inoculated during the processes of weeding and

planting out. The disease may exist for a considerable time on old infected tobacco refuse in the soil. Hence, if the seed-bed soil is not properly sterilised some plants may contract the disease from that source. The disease may be introduced from affected crops or weeds in the vicinity of the beds by workmen or insects. Furthermore, as has been already suggested, it may be carried to the seed-bed on the hands of workmen who have handled infected tobacco trash or cured leaf. Again, it has been demonstrated that active tobacco mosaic virus may exist in manufactured tobacco.[6] Hence infection could be introduced on the hands of a smoker. In some parts of America where cured tobacco is commonly chewed, and in Rhodesia where natives who tend the beds make their snuff from tobacco suckers, it is considered that the disease is frequently introduced by these agencies. Even if all the seedlings are perfectly healthy when transplanted, however, some infection may occur subsequently in the field from the remains of a previously affected crop in the soil, should that have been affected with mosaic.[3]

In Queensland where early priming is practised for the control of frog-eye, there is a danger of further distribution of the disease. As demonstrated by the experiments discussed above, it is when plants are inoculated during the seedling stage, and during the first month after transplanting, that they are most seriously affected, and consequently the greatest care should be practised up to this stage. Finally, during topping and suckering operations, still further dissemination of the disease may take place, and consequently it is not unusual to observe a large proportion of suckers showing mosaic symptoms.

Control.

In view of the foregoing remarks, certain precautions suggest themselves for the control of this disease. These precautions may be briefly summarised as follows:—

1. Destroy infected material in the seed-bed soil by efficient soil sterilisation, and avoid the introduction of any tobacco trash after the soil has been sterilised.

2. Eradicate any weedy patches which may occur in the vicinity of the beds, since many plants, weeds and otherwise, may carry the mosaic virus. Particular attention should be given to solanaceous plants.

3. At the commencement of the season all seed-bed equipment should be new or suitably sterilised.

4. After handling any tobacco, cured or otherwise, the hands should be thoroughly washed with soap and water, which will remove the mosaic virus, before working on the seed-beds.

5. The beds should be very carefully examined periodically for the presence of mosaic. Should it be observed, affected plants, as well as those in the vicinity, which may also be affected, should be removed. After handling such plants the hands should be washed. If a large proportion of seedlings are affected, which is unlikely, it would be advisable to abandon the bed and destroy the plants.

6. Examine the seedlings when lifting from the bed, and discard any showing suspicious symptoms. Thoroughly wash the hands in soap and water before proceeding with the work.

7. When the plants have become established in the field make a careful examination for mosaic before commencing priming operations and remove all diseased plants. If this precaution is neglected, and plants are inoculated during early priming, they are apt to become very seriously affected.

PLATE 226.

The same plants as shown in Plate 225 on 12th October. Note flower heads of healthy plant, and small distorted leaves and general stunting of mosaic-infected plant.

8. Make periodic examinations for mosaic since plants may contract the disease from contaminated soil in the field, or from infection by workmen or by insects.

9. Should the disease be serious in the field, and should it persist, notwithstanding the above precautions, then it would be advisable to practise a rotation of crops in which tobacco and other susceptible plants are not grown for a year or more.

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PLAIN TURKEY PROTECTED.

The Minister for Agriculture and Stock (Mr. Frank W. Bulcock) has called attention to a Press statement which apparently emanated from Mr. G. H. Barker, State Secretary of the Royal Australian Ornithologists' Union, to the effect that the plain turkey is to be protected closely for two years.

The Minister points out that the statement might convey an erroneous impression that it is intended to apply continuous protection to the plain turkey for the period mentioned, which, however, is not the case. It is intended to rigidly enforce the present protective periods, and to prosecute any offenders. As Mr. Barker has apparently misunderstood the information conveyed to him by the Minister, the text of the communication is supplied herewith:—

"In connection with the desire of members of your Union for total protection to be afforded the plain turkey, I have to inform you that it has now been decided to issue general instructions to officers of this Department and the Police that the protective provisions of "*The Animals and Birds Acts*, 1921 *to* 1924," relating to that bird, should be rigidly enforced during the close season, and that any breaches of the Acts should be reported for action by the Department against offenders.

"At present the periods of protection in this State are as follows:—

Southern Queensland (No. 1 District).—From the 1st October in each year to the 30th April in the following year, inclusive.

Central Queensland (No. 2 District).—From the 1st December in each year to the 30th June in the following year, inclusive.

Northern Queensland (No. 3 District).—From the 1st November in each year to the 31st May in the following year, inclusive

"In addition to the provision of partial protection as above, the plain turkey is totally protected in the Shires of Eacham, Tinaroo, and Woothakata, on the Cairns hinterland.

"Prior to the date on which the protective period will expire in the ensuing year, information will be sought as to whether the measures at present in force for the protection of the plain turkey are adequate."

Queensland Pine Beetle.

By A. R. BRIMBLECOMBE, Assistant to Entomologist.

BORER damage, occasioned to seasoned hoop pine manufactured into furniture or erected as walls, floors, or other structures, has been well known in Queensland for a considerable number of years. Until the end of 1931 the damage in all available records was attributed to a species of Anobium, namely—*Anobium punctatum* De Geer. At that date newly bred specimens of the common Queensland borer, as well as the series already in the collections, were found to belong to a totally different species which Mr. Henry Hacker, who is now in charge of the Departmental collections, identified as *Calymmaderus incisus* Lea. A thorough examination and dissection of a large series of borer-damaged hoop pine specimens was then made by the writer, and revealed in every case dead adults of the latter insect. Thus, since the type of damage was prevalent and *Anobium punctatum* was absent from the collections, it appeared certain that Anobium could be considered of little or no consequence in Queensland, and the transference of responsibility for damage to *Calymmaderus incisus* seemed reasonable.

However, in November, 1933, a hoop pine floor exhibited damage somewhat dissimilar to that of *Calymmaderus,* and on dissection of the boards dead adults and living larvæ were secured. These adults proved to be *Anobium punctatum.* This, then, is the first authentic Departmental record of that insect as a timber pest in Queensland. Recently a further record was obtained when a damaged board, extracted from a piano, revealed on dissection dead adults of this insect, the timber being of foreign orgin. In spite of these records, *Calymmaderus incisus* is still considered to be of greater economic importance in this State.

The European furniture beetle, *Anobium punctatum,* is of almost world-wide distribution. Consequently, it has been discussed in numerous publications both in Australia and abroad, and the present article is accordingly intended to deal primarily with *Calymmaderus incisus,* but because of their systematic affinity and the similarity in damage and control the two insects will be compared and contrasted.

Early Records.

The first reference in Queensland literature to Anobium damage occurs in the annual report of the Department of Agriculture and Stock for the year 1897-8, wherein Mr. Tryon notes "Introduced pine wood, Anobium beetle (?Theca sp.), Brisbane." Other early records occur in similar reports for the years 1898-9, 1902-3, 1905-6, 1907-8, 1910-11, and 1918-9. The first reference to a specific host appears in 1910-11, wherein Mr. Tryon reports, "Pinhole borer (Anobium sp.), white pine, *Araucaria cunninghamii*, Redland Bay and Brisbane, where it is becoming very prevalent and proving highly destructive."

Although *Calymmaderus incisus* was not described until 1924, it is quite likely, from the evidence just given, that some of the above early records refer to this insect. At any rate, specimens in the collections obtained from *Araucaria cunninghamii* in 1921 and placed under Anobium sp., have now been identified as *Calymmaderus incisus*; so this insect can be regarded as a pest of long standing.

Mr. Robert Veitch, Chief Entomologist, made, last year, the first reference in literature to the economic status of this species.[1]

Timber Attacked.

With one exception all the timber specimens from which the Queensland furniture beetle has been obtained, together with the flooring board which produced *Anobium punctatum*, on being submitted to the Forestry Sub-Department, were returned with the identification in every case as *Araucaria cunninghamii*—i.e., Queensland hoop pine. The single exception was a specimen of New Zealand white pine, *Podocarpus dacrydioides*, which was found to be heavily infested by Calymmaderus.

Roughly and Welch[2] give a list of Australian timbers, also one of exotic timbers, which are liable to Anobium attack. Of the Australian species, hoop pine is the only one so far confirmed in Queensland. W. W. Froggatt[3] reports that *Anobium punctatum* does not attack Australian timbers. Overseas, a variety of woods, such as alder, beech, birch, fir, dead ivy branches, oak, pine, spruce, and willow, are listed as hosts. Zacher[4] records it as eating holes in linen tablecloths.

Age and Nature of Timber Attacked.

Well-seasoned timber, as exemplified in buildings many years old, is the most liable to Calymmaderus attack. The older the wood the more favourable it seems to be. Specimens harbouring living larvæ possess an equilibrium moisture content of about 12 per cent., although this degree of dryness is not claimed as the only factor conducive to attack. Timber, in ageing, changes slightly in chemical composition, which fact might exercise a selective influence on gravid females.

The timber from which Anobium was recently taken was reputed to be forty years old and had an equilibrium moisture content of 12 per cent., while Calymmaderus is breeding in a house supposed to be more than thirty year old. With both insects, once infestation has occurred, reinfestation may proceed, producing several generations from the same site, until the wood is reduced to a honeycombed mass, when attraction declines.

Nature and Extent of Damage.

A piece of infested timber sliced longitudinally exhibits an admixture of various sized holes, which illustrate the nature of the grub's progress. The minute holes are practically all cut transversely, indicating that a newly-hatched grub from an original infestation tunnels perpendicularly to the surface. The larger tunnels are exposed in all directions. The more mature grub, by avoiding cutting into earlier-formed portions of its own tunnel or severing the tunnels of other individuals, travels wherever sufficient solid wood permits, and accordingly its course is exceedingly devious. At all times it avoids breaking the exterior surface. This, however, is punctured by the beetles when emerging from the pupæ a year or more after egglaying. It is evident, then, that in instances of original infestation the first external indications of depredation are the exit holes of the adults, but, unfortunately, in the meantime damage will have been effected, for the preceding grub stage does all the internal tunnelling. In Plate 227, figs. 2 and 4, the portions illustrated reveal only a few exit holes, whereas the underlying damage is extensive; so the number of holes is of little significance in estimating the severity of attack. The beetles, after emergence, do no more actual harm to the timber.

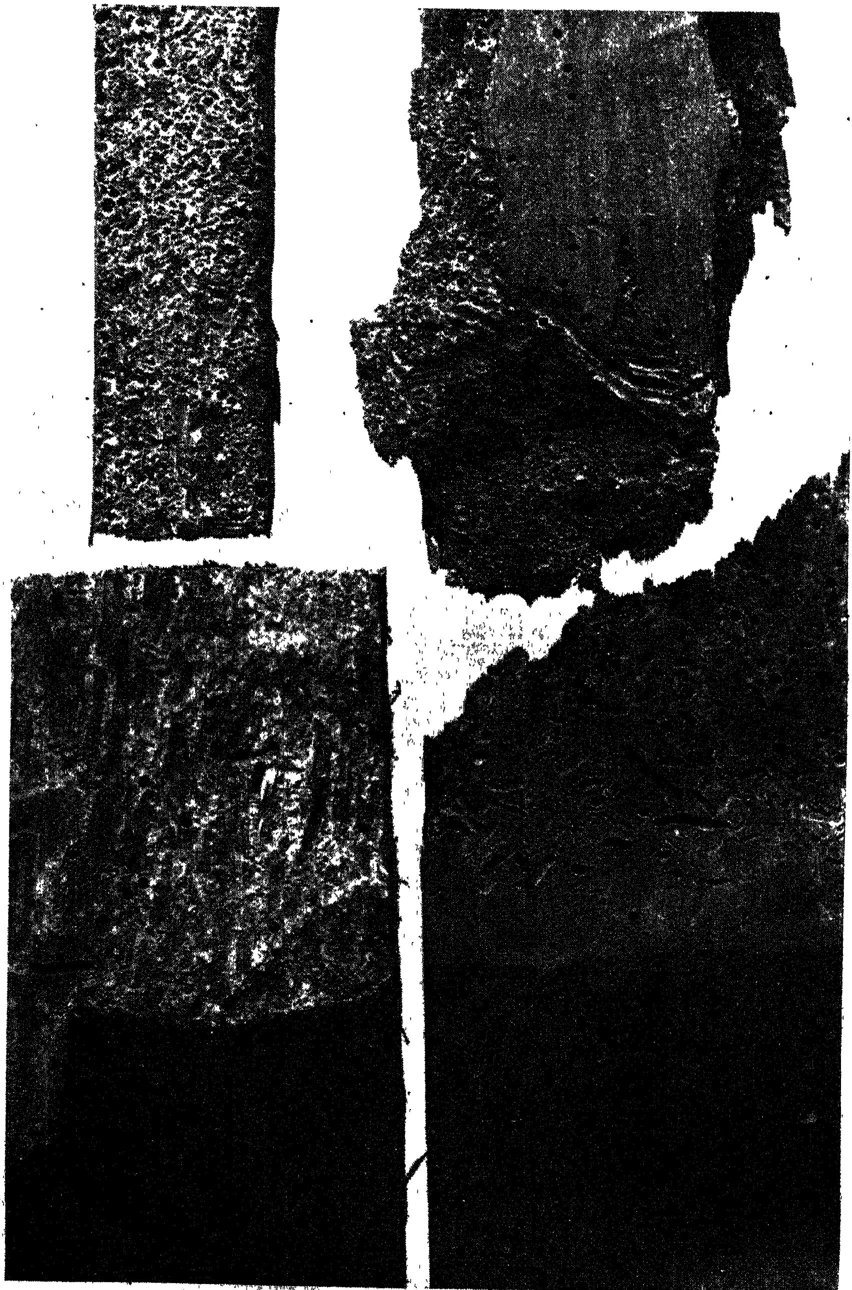

PLATE 227.

Fig. 1 (top left).—Hoop pine damaged by *Calymmaderus incisus.* Lateral view of portion in Fig. 2 showing thinness of outer shell.

Fig. 2 (top right).—Hoop pine heavily damaged by *Calymmaderus incisus.*

Fig. 3 (bottom left).—Hoop pine damaged by *Anobium punctatum.*

Fig. 4 (bottom right).—Hoop pine showing internal damage and exit holes of *Calymmaderus incisus.*

Attack is not necessarily confined to any particular part of the timber. Whether it is sapwood or truewood, the final degree of damage is the same, although in a few instances the proportion of exit holes from the first generation was greater in that part of the board nearer the sapwood. Board to board grub dispersal may occur, but not extensively, and cumulative infestation of timber is almost invariably due to egglaying by the beetles. While the degree of initial infestation varies, it is generally light, although in one instance a ceiling exposed to a large population of beetles became infested in practically every board and for the whole length of the boards. Usually, general infestation obtains only with the progress of succeeding generations. If the insect remains unchecked the whole hoop pine interior of a building may become affected. Ultimately the infested wood is reduced to a honeycombed spongy or crepe rubber-like mass covered by a thin shell punctured by exit holes (Plate 227, fig. 2). So great has been the damage in many instances that hoop pine furniture and shelves have collapsed, and floors have broken under the weight of heavy furniture, while a lead pencil may be pressed through heavily infested floors and walls. A heavily damaged board 6 inches wide and ¾ inch thick snapped in the hands almost as easily as a match splinter.

The above information is also fairly true of Anobium, except that the damaged timber has not the same spongy nature. Anobium tunnels may be devious, but there is a greater tendency for them to be parallel to the surface and to one another (Plate 227, fig. 3).

The Calymmaderus damage is characterised and may be identified by the frass (Plate 228, fig. 2) with which the grubs fill the tunnels. This consists of undigested material and rejected particles which, intermixed, fill the tunnels closely but not tightly, for when exposed it can be easily shaken out. The undigested material is in the shape of small elongate oval pellets, slightly pointed at one end and typically of a very hard consistency. In old hoop pine they are mostly darker in colour than the rejected particles and surrounding wood; the colour difference in New Zealand white pine is not so striking. The proportion of pellets to rejected particles is large.

The frass of Anobium grubs (Plate 228, fig. 1) is somewhat different. The pellets are smaller and of a more crumbly consistency; in old hoop pine they are not different in colour from surrounding wood, and the proportion in comparison with rejected particles is not so large.

Origin and Distribution.

Apparently *Calymmaderus incisus* is indigenous to Queensland; no record of its occurence elsewhere has yet appeared. It was originally described from specimens taken in Brisbane, and it is to this State that its natural host, hoop pine, is indigenous.

Most sections of the Brisbane area have yielded records of Calymmaderus damage, and the beetle population therein is evidently very high. The occurrence of damage in such widely separated towns as Southport, Sandgate, Petrie, Redcliffe, Nambour, Tewantin, Imbil, Gympie, and Maryborough indicates a long range, comparatively near the coast of south-eastern Queensland Whether it extends within the tropic or to the interior has not yet been ascertained. *Anobium punctatum*, as previously mentioned, is of almost world-wide distribution, and is considered to be native to Europe.

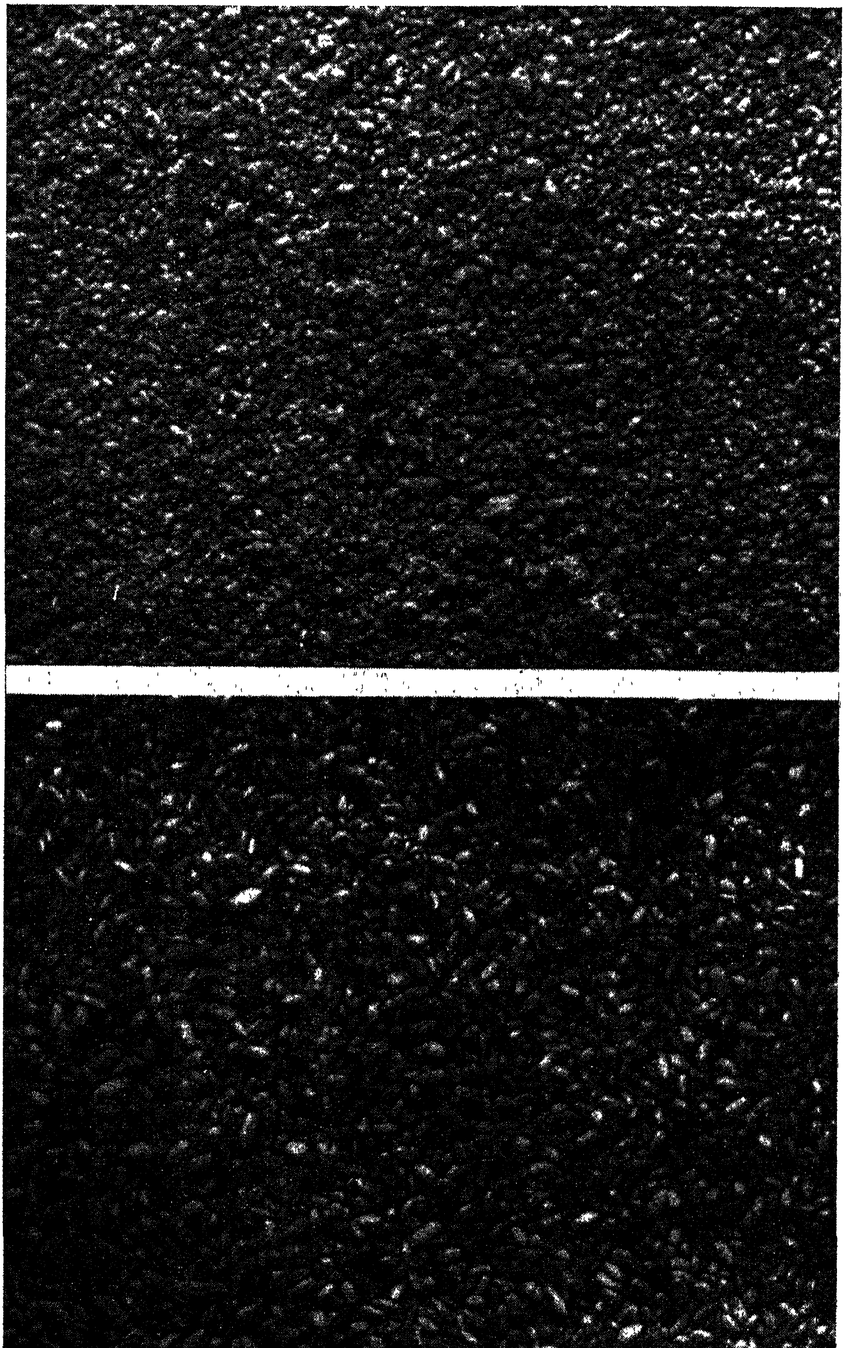

PLATE 228.

Fig. 1 (top).—Frass of *Anobium punctatum* × 7½.
Fig. 2 (bottom).—Frass of *Calymmaderus incisus* × 7½.

Habits and Life History.

The eggs of Calymmaderus in initial attacks are deposited in depressions on the sawn board ends or in cracks in the boards, while the spaces between tongued and grooved boards are particularly attractive for egg-laying. A favourite site for eggs of subsequent generations is within the old exit holes. When placed in cavities on board ends they are below or flush with the surface level. Small openings such as these are chosen possibly because of the initial leverage required by the minute grub in gaining entrance to the timber as well as for protection during incubation. All sixteen eggs laid in the laboratory were deposited in cavities on block ends—three in one opening, four in pairs, and the remaining nine singly. The actual period required to incubate these eggs was not definitely determined, but occupied three to four weeks.

The beetles of Anobium choose similar sites for oviposition. Overseas records show that a single individual may lay from twelve to forty eggs, and the incubation period may occupy about three weeks.

The newly-hatched Calymmaderus larva is minute, and the tunnel it bores is correspondingly small—in fact, is no larger in diameter than the prick of a pin point. It immediately enters the timber in a direction perpendicular to the surface chosen for oviposition wherever that may be, thus working away from the light. Although the optical organs are rudimentary, the perception of light is remarkable, and at all times the breaking of any exposed board surface is avoided. Even very small tunnels deflect the course of the young grub, but to the older ones these present little hindrance. As growth proceeds the grub moults three times, the third moult producing the pupa.

The tunnel to accommodate the grub becomes increasingly larger until the trail left by a mature grub is circular and 1·5 to 2·0 mm. in diameter (Plate 227, figs. 2 and 4). Due to the curved nature of the grub the posterior end, which is studded with a few spines, presses against the tunnel wall, and this causes the dorsal surface, which is provided with bands of spines, to come into close contact with the wall above. Thus there is ensured a keen purchase to enhance the efficiency of the stout, hard jaws which, by chewing off pieces of wood, most of which are swallowed, effect the grubs progress through the timber. When placed on a flat surface the young grub can crawl very slowly, but the older individual in similar circumstances is helpless. Mastication of the hardwood fibres occurs in the muscular gizzard on the inner walls of which are innumerable spines for thoroughly effecting maceration.

Subject to a heavy infestation the wood decreases appreciably in weight, but the actual pieces chewed off do not cause this, for they do not leave the timber. The nourishment taken from them is converted into energy, which is dissipated as the grubs work. This conversion to energy, which is totally lost as far as measurable weight is concerned, is the explanation for diminished wood weight.

When the grub is full grown, its tunnel is usually directed to a suitable position just beneath the timber surface, where a pupal chamber is excavated. Often, however, especially in fairly heavily damaged wood, the pupal cells occur at quite considerable depths. The pupal chamber is oval in shape, 4·0 to 5·0 mm. long, and half as wide. The grub now completely confines itself by sealing the tunnel with fibre fragments and frass glued together in the form of a neat circular concave

cap. After a while it casts its skin, which passes to one end of the chamber, and the insect is now in the pupal stage.

The larval period has not yet been completely determined. This period might be ten or eleven months; however, it is not improbable that it might extend well over a year, since as late as April, 1934, when cool weather was approaching, first and last stage larvæ were both abundant. These first-stag grubs definitely were from eggs laid during the season immediately past; the third-stage grubs must have developed from the previous season's eggs and will not emerge as adults until next spring.

The habits of the Anobium larva are somewhat the same as those of Calymmaderus, except that the tunnels it bores are more inclined to run parallel to each other. Its food has been found to consist chiefly of cellulose, of which the wood cell walls are partly composed. Falck[5] noted a decrease of about 9 per cent. of cellulose in attacked pine sapwood. The larval period under normal conditions lasts for ten or eleven months, but in very warm climates it may be less than six months, whereas in cooler countries it may extend over two years. Pearson[6] had under observation larvæ which had not completed the stage in two and a-half years.

When the insect is about half way through the pupal stage the eyes slowly turn black; later the brown jaws are discernible through the pupal skin; then shortly the whole becomes light-brown, due to the development of the adult within. Eventually the adult splits the skin about the region of the thorax, and as the beetle emerges this skin is pushed along the body and off at the posterior end. However, the adult is still immature, and so rests within the cells, where it slowly darkens in colour and gains in strength. Ultimately, it burrows to the exterior, making the obvious exit hole so indicative of borer presence. For both Calymmaderus and Anobium the pupal period occupies from three to four weeks.

The short resting spell of the adult within the pupal cell is probably of sufficient duration to permit the complete development of the reproductive organs allowing the beetle to commence mating immediately on emergence. Egg-laying, then, can probably be anticipated shortly after the appearance of exit holes. The gravid female wanders over the timber surface, with its antennæ extended, searching for suitable egg-laying sites. On locating a favourable cavity it inserts its ovipositor, which neatly places the egg. As mentioned in an earlier paragraph, of sixteen eggs, three were in the one cavity, four were in pairs; the others occurring singly, the number occurring in each cavity probably being dependent on the size of the cavity. The total egg production possible from a single female is not known. Oviposition may extend over several widely separated sites; and as adults can fly freely, house to house dispersion takes place readily. Great activity becomes evident amongst adults at dusk, and possibly continues into the night, while in a fairly dark room they remain exposed and active even at midday.

A disturbed beetle does not take to flight or scamper away, but a passive disposition is assumed in which it is difficult to say whether the insect is dead or alive. The head is retracted under the cowl-like prothorax, the legs are tightly adpressed to the body in suitable depressions, and the mouth points backwards, enabling the antennæ to fit conveniently into a cavernous sternal groove, completely accommodating

and protecting them. The form now assumed is a small oval solid, which should be effective in resisting external forces. If dropped, a beetle in this passive state immediately takes to flight.

This habit is also common to the Anobium beetle. The head and appendages are retracted, but because of the insects' more elongate form, and the absence of suitable depressions for the legs, the even oval shape of Calymmaderus is not possible. In other general habits the adult Anobium may be likened to that of Calymmaderus.

Seasonal History.

Adults emerge from October to February, over the whole of which period egg-laying occurs. The grubs may continue to tunnel during the winter or may remain dormant for a while, their activity or otherwise depending on the severity of the weather. With the advent of spring, grubs from eggs laid early in the preceding season might give rise to pupæ. Experimental work also indicates that grubs from late eggs might have an extended period continuing into the following summer and not emerge as adults until the second spring. Possibly such factors as climate and condition of wood exercise significant influence on the life-cycle period. Pupation commences in the spring, and by extending into the summer makes available adults at various times during the warmer weather, so oviposition can be expected at any time in the summer.

Anobium is recorded as having normally a yearly cycle, but under warm conditions two generations a year are known[7], whereas in cooler climates the life cycle extends to two years and over[6].

Vernacular Name.

In literature *Anobium punctatum* is referred to as the "furniture beetle," and in Europe is designated the "common furniture beetle." Although its depredations are not confined to furniture, the name is retained because of long usage. Because of the general similarity to Anobium, *Calymmaderus incisus* had provisionally received the name "Queensland furniture beetle." Here again the greater percentage of damage is to wooden structures other than furniture. For this reason, together with the facts that the insect is indigenous to Queensland and has been bred only from pine, it has now been designated the "Queensland pine beetle."

Systematic Position.

The Queensland pine beetle was described as *Calymmaderus incisus* by the late A. M. Lea in "Transactions of the Royal Society of South Australia," vol. 48, p. 53, 1924, from specimens obtained in Brisbane. It belongs to the family Ptinidæ, subfamily Anobiinæ; hence its relationship to *Anobium punctatum* described by De Geer in 1774.

Most members of this subfamily are of economic importance, other well-known species being *Sitodrepa panicea* Fabr., which is highly destructive to numerous dry preserved products, and *Lasioderma serricorne* Fabr., which causes considerable loss to stored tobacco.

The borers Calymmaderus and Anobium must not be confused with the common and notorious "powder post beetle," *Lyctus brunneus* Steph., which belongs to a totally different family of insects and has never been bred from hoop pine.

Description of Stages.

The very small white egg (Plate 229, fig. 1) is ·4 mm. in diameter and is just discernible to the naked eye. The shape is more or less spherical, but that portion of the egg in contact with the timber may assume the shape of the cavity into which it has been placed. The egg shell or chorion exhibits a remarkably pretty reticulate appearance, numerous minute protuberances being present. The egg of Anobium is also minute, white in colour, but oval in shape.

The Calymmaderus grub (Plate 229, fig. 2) is soft bodied, curved, and wrinkled, and is creamy-white in colour except round the mouth, where the mandibles are dark-brown. When full grown it measures 4·0 to 5·0 mm. in length and 1·5 mm. in width, being widest at the thorax, each segment of which is provided with a pair of short white five segmented legs. The anal body segment is broadly rounded and slightly wider than the others, due to a tendency to lateral lobing. The outer portion of the maxilla—i.e., the maxillary palp is four segmented, short, and peg-like, while the inner part is provided with numerous blunt processes, giving it a comb-like appearance. The labial palps are similar to those of the maxillæ. The whole body is clothed with numerous fine hairs. Each segment, from the third thoracic to the fifth abdominal, is provided dorsally on the more elevated portion with a band of brown spines slightly curved backwards at the tips. Posteriorly on each side of the last abdominal segment is a group of similar spines varying from eight to fifteen in number. None of these spines occur in the first-stage grub, while in the second stage they are few in comparison with the last stage, and often are in only one row. A spiracle is situated on each side of the first thoracic and first to eighth abdominal segments, the spiracles being practically uniform in size.

The Anobium larva (Plate 229, fig. 6) is very similar to Calymmaderus in general features. The only obvious difference and a good one distinguishing the larvæ of the two species is that the Anobium grub has eight bands of dorsal brown spines, while Calymmaderus has only six; again the Anobium larva has no spines on the anal segment. Gahan[8] mentions the dorsal spines as being in a double row in Anobium, but a series of grubs recently examined indicates that although there may appear a tendency towards two rows, the arrangement is by no means regular. Sometimes one or three rows are distinct. The same applies to Calymmaderus.

The pupa (Plate 229, fig. 3) is soft, oval, creamy-white, and measures 3·0 to 3·5 mm. in length and 1·5 mm. across the thoracic region. The wing covers fold round to the under side, where they pass between the second and third pairs of neatly folded legs, while the antennæ lie along the side of the body outside the wing covers and above the knees of the first and second pairs of legs. There is no obvious difference in the Anobium pupa except that it is slightly longer.

The Calymmaderus beetle (Plate 229, fig. 4) is oval in shape, 2·5 to 3·0 mm. long, and 1·25 to 1·5 mm. wide, the general colour being a shining bright castaneous. Over the body surface is a minute shining pubescence and numerous minute punctures, neither discernible to the naked eye. When a beetle is specially cleared, a series of punctures arranged in longitudinal rows on the elytra are revealed, while scattered generally over the surface are smaller punctures, from which the pubescence arises. On the margin of each elytron are two distinct striæ.

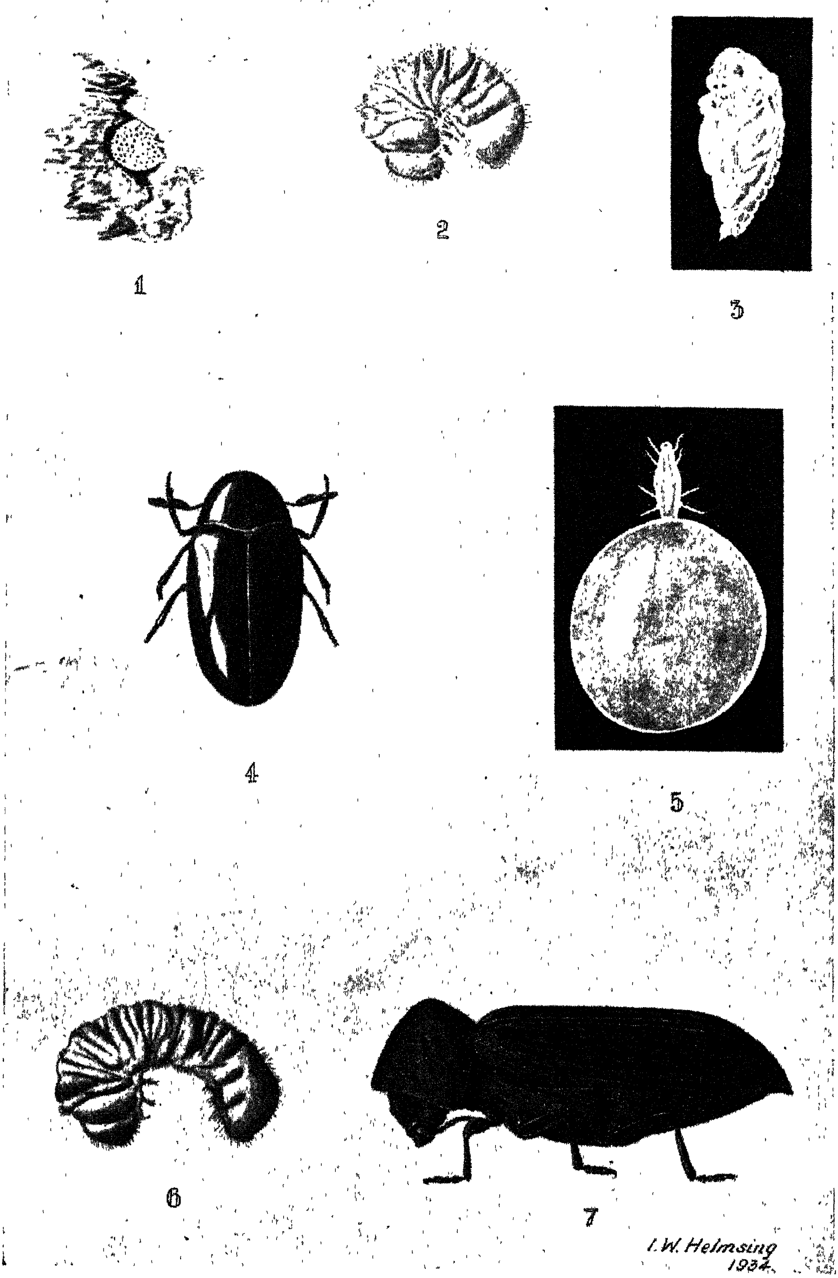

PLATE 229.

Fig. 1.—Egg *in situ* of *Calymmaderus incisus* × 24.
Fig. 2.—Larva of *Calymmaderus incisus* × 8.
Fig. 3.—Pupa of *Calymmaderus incisus* × 8.
Fig. 4.—Adult of *Calymmaderus incisus* × 15.
Fig. 5.—Adult female of *Pediculoides ventricosus* × 60.
Fig. 6.—Larva of *Anobium punctatum* × 8.
Fig. 7.—Adult of *Anobium punctatum*, × 15.

Antennæ consist of eleven segments, of which the basal one is large, second smaller, third smaller still, but fourth to eighth smallest and about equal in size. The ninth is largest, oblong, and as long as the tenth and eleventh combined, each of which is about equal in length to the first segment. The last three segments give the appearance of a large elongate club clearly visible when the antennæ are extended. Maxillary palps are four segmented, labial palps three segmented; the terminal segment of each is dilated interiorly into a hatchet-like blade. The legs are moderate, and the tarsi consist of five segments—the first largest, the others about equal in size. The fore and mid legs are contiguous, but the mid and hind legs are widely separated by the prominent metasternum. The mesosternum is inconspicuous. The prothorax narrows anteriorly and, dorsally, is simply curved not angled as in Anobium. Impressed into the prosternum, over the whole of the mesosternum, and into the anterior of the metasternum is a common depression for the fore and mid legs when folded. The first abdominal sternite and the hind part of the metasternum provide similar depressions for the hind legs; the first abdominal sternite then appears as a curvilinear triangle, with the apex anteriorly. This apex fits into a corresponding socket in the metasternum. The cavernous sternal groove involves the prosternum and mesosternum, and continues into the metasternum, where it ends abruptly, corresponding with the blunt end of the last antennal segment.

The adult Anobium (Plate 229, fig. 7) differs from Calymmaderus in many respects. In shape it is more elongate, being 4·0 to 5·0 mm. in length, and the colour varies from reddish-brown to dark-brown, modified by a clothing of fine short paler coloured hairs. Clearly visible on the elytra are a series of longitudinal grooves, along which are numerous closely-set punctures. The prothorax in lateral view is distinctly angled or cowl-shaped. The sternal groove is present and continues further into the metasternum, but it is not so cavernous and shallows gradually, corresponding with the tapering last antennal segment. The legs in comparison with Calymmaderus are longer, and although they may be neatly folded, they do not fit into accommodating depressions. The fore and mid legs fit into the angles between the prothorax and elytra; the hind pair fit behind the metasternum since this is slightly larger than the first abdominal sternite. The last three antennal segments are about equal in length and also give a clubbed appearance.

Natural Enemies.

Both the larval and adult stages of Calymmaderus and Anobium are preyed upon by a small mite, *Pediculoides ventricosus* (Newp.) (Plate 229, fig. 5), which also has been recorded from Anobium grubs in Russia[7]. This mite is responsible for the death of quite a number of grubs. As many as twenty-three females and several young mites have been found associated with one dead Calymmaderus larva, six to twelve female mites per grub being common. The beetle larvæ having soft bodies may be attacked anywhere, although on the ventral side under the arched body is preferred. The adults, however, are heavily chitinised except on the upper side of the abdomen under the elytra, and it is here that the mites are usually found. Even so, the percentage of control it exercises is small, because the dispersion and isolation of grubs and adults is not conducive to a general attack by the mites. At the same time the presence of this mite in a dwelling is not really desirable, for

it may attack human beings also. Uncomfortable conditions were experienced by the writer when working with material infested by this mite. This is in agreement with reports in a recent article by Swan[9] in South Australia, who calls it the hay itch mite and who has completely worked out its biology.

Anobium is parasitised by a small hymenopterous wasp of the family Braconidæ. Again the degree of control is not large. Overseas there are recorded several Braconid parasites and a few coleopterous predators of the family Cleridæ and one of the family Trogositidæ.

Artificial Control.

Since the recorded natural enemies give little help in the attack against these borers, alleviation of infestation must necessarily be sought in the application of artificial measures. From the outset it must be recognised that in this respect the problem of control is an extremely difficult one, because the destructive insect stage is well entrenched within the timber and securely protected against ordinary control practices. Even though certain recommendations are outlined below, these are not absolute in efficiency, but if persevered with they will considerably minimise if not eliminate the cause of the trouble. A great disadvantage presents itself in that, when original infestation occurs, there is no indication of its presence, the appearance of exit holes being the first evidence of attack. Even though only a few of these are present, the underlying damage may be extensive, for the grubs have been tunnelling for some considerable time previously. Control efforts, then, must be to take immediate steps to kill the insects remaining in the timber and to prevent reinfestation or spread to new sites.

When to Apply Control.

The salient life history features affecting control are that the female is free-living and causes reinfestation or spreads the attack, eggs are more or less exposed, and young and very old grubs, pupæ, and emerging adults are comparatively near the surface. A control applied at a time corresponding to the insects' presence near the surface should prove beneficial, and such a time is the spring. Control applied during that season should accordingly reduce the number of potential adults. At least one subsequent treatment should be made about six weeks later in order to kill insects which earlier were too deep to be affected and which now should be approaching the outer surface.

Preventive Measures.

In the normal course of events most hoop pine interior walls are now painted and the pine floor stained, but following this the under-surface of the floor and the board ends usually projecting under the building against the beams should receive some protective coating, such as creosote. Any exposed cracks appearing later, due to shrinking of the boards, should be treated with paint or creosote as the case demands. In this way all egg-laying sites are eliminated. Even though floors have been stained above or covered by linoleum, instances of attack are exceedingly numerous and invariably originate from below, which, then, is a vital point in preventing infestation. This can quite easily be completely overcome by substituting for flooring purposes seasoned hardwood, which is as cheap or cheaper than hoop pine.

Combative Measures.

Control in most cases is possible only from the exterior, the best method being to apply some liquid possessing penetrative power and evolving a gas which spreads still further. At the same time it might be possible to include a poison in the mixture used, to become absorbed by the timber, thereby killing any insects chewing the impregnated wood. Several penetrative materials are already on the market or can easily be prepared.

Heavily infested boards may be so reduced in stability as to become dangerous, and these should be removed and burned. Replacements and lightly attacked timber should then be treated. The liquids can be applied by a brush or spray pump, and can be injected into any exit holes by means of a suitable syringe. If only a few holes are showing, injections alone are insufficient on bare boards, as the effect then is only localised; so in any case, brushing or spraying is essential. The best mixture applied to the outer surface unfortunately penetrates to a depth of only about one-eighth of an inch. For this reason each application kills only a proportion of the insects within, hence with repeated treatments at suitable intervals the effects are cumulative. At the same time the coating on the surface renders it unsuitable for further egg-laying.

Methods of Treatment.

Heavy-grade creosote is an effective oil for general application, and is readily available on the market at a relatively low cost. It possesses fair penetrative power and evolves a good concentration of gas, and both liquid and gas effect a kill when they come into contact with living borers. This creosote, however, causes a dark, flat, or dull stain, which in itself is not really objectionable, but the success of subsequent coats of paint, varnish, or polish might be impaired.

The creosote can be diluted with kerosene, a suitable mixture being equal parts of each. This leaves a light stain, and the rate of evolution of the fumes is slightly reduced. A dilution of one part of creosote to eight of kerosene has been recommended, and although this still leaves a very light stain when heavy-grade creosote is used, a good varnish finish is possible with two coats. There is, however, a refined creosote on the market which itself produces little or no stain, and though the rate at which fumes are evolved is said to be very much slower than the heavy grade, it may meet requirements in certain cases.

Kerosene alone might in individual instances prove beneficial, but penetration is not very good on fairly solid timber. The same objection applies to turpentine alone, yet a mixture of these two in equal parts has given more favourable results, although its action is much slower than a material containing creosote, and consequently more applications will be necessary.

Another suitable mixture is paradichlorobenzene dissolved in kerosene, at a strength of 1 lb. of paradichlorobenzene crystals to 1 gallon of kerosene. The liquid, orthodichlorobenzene, used alone might be considered costly, but mixed in kerosene to give a 5 to 10 per cent. solution it makes a reasonably priced mixture. Neither of these preparations leaves any stain.

Painting appears to be the most suitable method of applying the above liquids and entails no special apparatus. Spraying may be more

convenient and quicker if the right pump nozzle is available. Certain nozzles produce a mist so fine that there is little adherence to the timber, while with others considerable splashing results. In all cases the degree of control depends on the thoroughness of the work.

Reasonable care must be exercised in the application of the above-mentioned chemicals, for contact with the skin may induce irritation, and they must not be exposed to naked lights, for the mixtures are inflammable.

Preparations containing soluble poisons, such as sodium arsenite, zinc chloride, or mercuric chloride, do not effect such a rapid kill as one including creosote, for a proportion of the poisoned timber must be swallowed before death ensues. These chemicals are so very poisonous that they are not recommended unless in the hands of skilled workers.

Fumigation is another possible means of control. This is more restricted in its application, since an airtight room or container is essential; for this reason the method is more appropriate to treatment of infested furniture or other comparatively small articles. Carbon bisulphide may be employed exposed in several shallow vessels, or poured over cotton wool or absorbent cloth at the rate of 1 lb. per 250 cubic feet of space. Paradichlorobenzene may be sprinkled at the rate of 1 lb. in 25 cubic feet. Exposure to the fumes must be maintained for several days, or even up to a week, to enable complete penetration of the borer tunnels. When small articles are to be fumigated it might be more convenient to communicate with firms possessing the necessary chamber, of which there are several in Brisbane, and who might treat material at a reasonable cost. Fumigation, although thorough in killing all living insects in the timber, is no guarantee against reinfestation, and a protective coating is therefore necessary.

Summary.

The beetle, *Calymmaderus incisus* Lea, has recently been discovered to be the causal agent of considerable and serious damage to seasoned hoop pine in Queensland. Although not described until 1924, it was undoubtedly responsible for considerable losses at a much earlier date. Its range, as at present known, covers the whole south-eastern portion of this State. All stages have been obtained, and life history work is proceeding in the laboratory, but as yet the life-cycle study has not been completed. Hoop pine and New Zealand white pine are attacked, the timber eventually being reduced to a sponge-like mass. Complete descriptions of habits and stages are given. At present creosote alone, or mixed with kerosene, and painted on affected timber, first in the spring, with at least one treatment later in the summer, is the best method of control.

Anobium punctatum De Geer occurs in Queensland, so far only to a minor extent and only in hoop pine. In this article it is compared and contrasted with *Calymmaderus incisus* in all details.

Acknowledgments.

Thanks are expressed to Mr. Robert Veitch, Chief Entomologist, for granting facilities for this work, and to Mr. I. W. Helmsing, whose excellent illustrations enhance these notes. The writer is also much indebted to several officers of the Forestry Sub-department who have assisted materially in this investigation.

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CLEANLINESS IN THE DAIRY.

Professor J. K. Murray, Principal of the Queensland Agricultural College and High School, said, in the course of a recent address, that the effects of impure water in the manufacture of butter lay mostly in its adverse effect on butter quality, and this arises in the use of such water on the farm in milk production as well as in the factory. The factory was unable to offset entirely the bad effects of dairy farm methods which did not conform with good hygienic practice. Deodorisation, pasteurisation (and its variants such as stassanisation) could remedy only a portion of the ill-effects of farm and transport procedures which, for whatever reason, did not reach a high standard. The watering of cows which allowed of the flanks and udder becoming contaminated from muddy water made it almost certain that the milk would be contaminated by the water residues from the flanks, udder, escutcheon area, and tail. This could be partly offset by the cleaning of the cow's flanks, tail, udder, and teats before milking, but clean watering was an advantage.

The washing of milk pails, strainers, separator parts, cream cans, &c., in contaminated water almost made it certain that the microbes would bring about their undesirable changes in the milk and cream before it reached the factory. Good-quality water should be used, and the immersion of utensils in boiling water for a minute would remove danger from this source. During the earlier stages of the milk's history the putrefactive group might do their most marked work because of the near approach of the milk at that stage to neutrality.

The harmful gas-forming group of bacteria was a notable contaminant of milk when impure water was used or manurial contamination occurred in farm practice. This group could work in milk in which acid was being produced by themselves or other bacterial groups, and was favoured during storage and transport to the factory by the warm conditions prevailing in the Queensland summer. Distinctly off-flavours resulted and gas was produced. Yeast contamination, ropy milk outbreaks, and other phenomena of lesser importance had also been traced to farm-washing waters.

The cooling of cans by dirty wet bags could result in the contamination of milk or cream by dirty water. Prolonged transport allowed of longer activity by organisms derived from dirty water, and the remedy rested in better roads with their lower haulage costs and the more frequent delivery this made possible. Faster rail transport, such as the rail-motor had made possible in connection with some of the factories, lessened the amount of undesirable substances produced before the vast majority of the microbes still forming them were destroyed by pasteurisation.

The passing of the nearest factory by the supplier was, other things being reasonably equal, definitely against the interests of the industry.

The Parasites of Poultry.

By F. H. S. ROBERTS, M.Sc., Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

THE external parasites of the domestic fowl include the poultry tick and several species of lice and mites.

THE POULTRY TICK (Argas persicus).

A. B.

PLATE 230.—THE POULTRY TICK (*Argas persicus*) (A) and (B).
A.—Male. B.—Female.

Description.

This is a flat, oval, brownish tick about one-quarter to half an inch in length. The mouthparts are situated ventrally between the front legs, and it is only by turning the tick on its back that these can be seen. It is a powerful bloodsucker, and, like the bed bug, feeds only at night, remaining hidden in cracks and crevices in the fowlhouse during the day.

Life History.

The female tick may lay 500 to 900 eggs during her lifetime, in several batches. These eggs are deposited in sheltered positions, and under favourable conditions may hatch in about ten to fifteen days. The tiny tick that emerges from the egg has only three pairs of legs, and almost immediately after hatching attaches itself to the fowl, preferring the skin on the breast, under the wing, and on the thighs for this purpose. In three to ten days' time it is fully engorged with blood, and, leaving the fowl, seeks a suitable hiding-place, in which it casts the skin, to appear as an eight-legged nymph. There are two further moults before the adult stage is reached, but, like the adult, these nymphal stages feed only at night.

Effect on the Fowl.

When ticks are numerous, their bloodsucking habits result in distinct injury to the birds attacked. This is due to the amount of blood sucked up by the ticks and to poisonous substances injected whilst feeding. Young chickens are most seriously affected, and the weakness caused by the tick may often be fatal.

The fowl tick is also very important, as it is the carrier of an organism which is responsible for fowl tick fever, which is a serious, and usually fatal, disease among fowls.

Control.

This tick is a very difficult pest to deal with, as not only is it resistant to ordinary insecticides, but its habit of hiding in deep cracks, &c., protects it to a very large extent from any spray treatment. A badly infested fowlhouse, if of little value, should be burnt as it stands. As adult ticks are able to live as long as four years in an empty fowlhouse, it is of little use excluding the fowls for any length of time as a control measure.

Crude oil makes a satisfactory spray, and should be forced well into all cracks and crevices, &c. Before spraying, all litter, nesting straw, and loose boards likely to protect the ticks should be removed and burnt. The spraying treatment should be repeated every three to four weeks until no more ticks are seen.

In addition to spraying, fowls may be protected from the ticks if the perches are so arranged as not to touch the fowlhouse walls. They may be swung from the roof on wires or else placed on supports rising from the floor. The perches should be frequently painted with crude oil. Nesting boxes, moreover, should be placed well away from the roosts, and are best constructed of metal.

Special coops should be set aside so that any bought fowls may be quarantined as a precaution against bringing in fresh infestations. The period spent in these coops should be about twelve days, and the coops should be kept thoroughly clean and well sprayed.

LICE.

The lice found on the domestic fowl are all biting lice, and there are at least six species occurring on fowls in Queensland. These various species are given popular names according to the part of the body or feathers on which they are most frequently found—namely, wing lice, head lice, body lice, shaft lice, and fluff lice. The various species are illustrated in Plate 231, figs. 1-6.

Lice infestation is most serious among chickens, and the irritation resulting from their presence may sometimes be fatal. Among grown fowls lice infestation is shown mainly by a decreased egg production.

POULTRY LICE.

Description of Plate 231.

Fig. 1.—Wing Louse (*Lipeurus caponis L.*) × 24.
Fig. 2.—Fluff Louse (*Goniocotes hologaster* Nitzsch) × 24.
Fig. 3.—Slender Pigeon Louse (*Columbicola columbiæ L.*) × 24.
Fig. 4.—Head Louse (*Lipeurus heterographus* Nitzsch) × 24.
Fig. 5.—Body Louse (*Eomenocanthus stramineus* Nitzsch) × 24.
Fig. 6.—Shaft Louse (*Menopon gallinæ L.*) × 24.

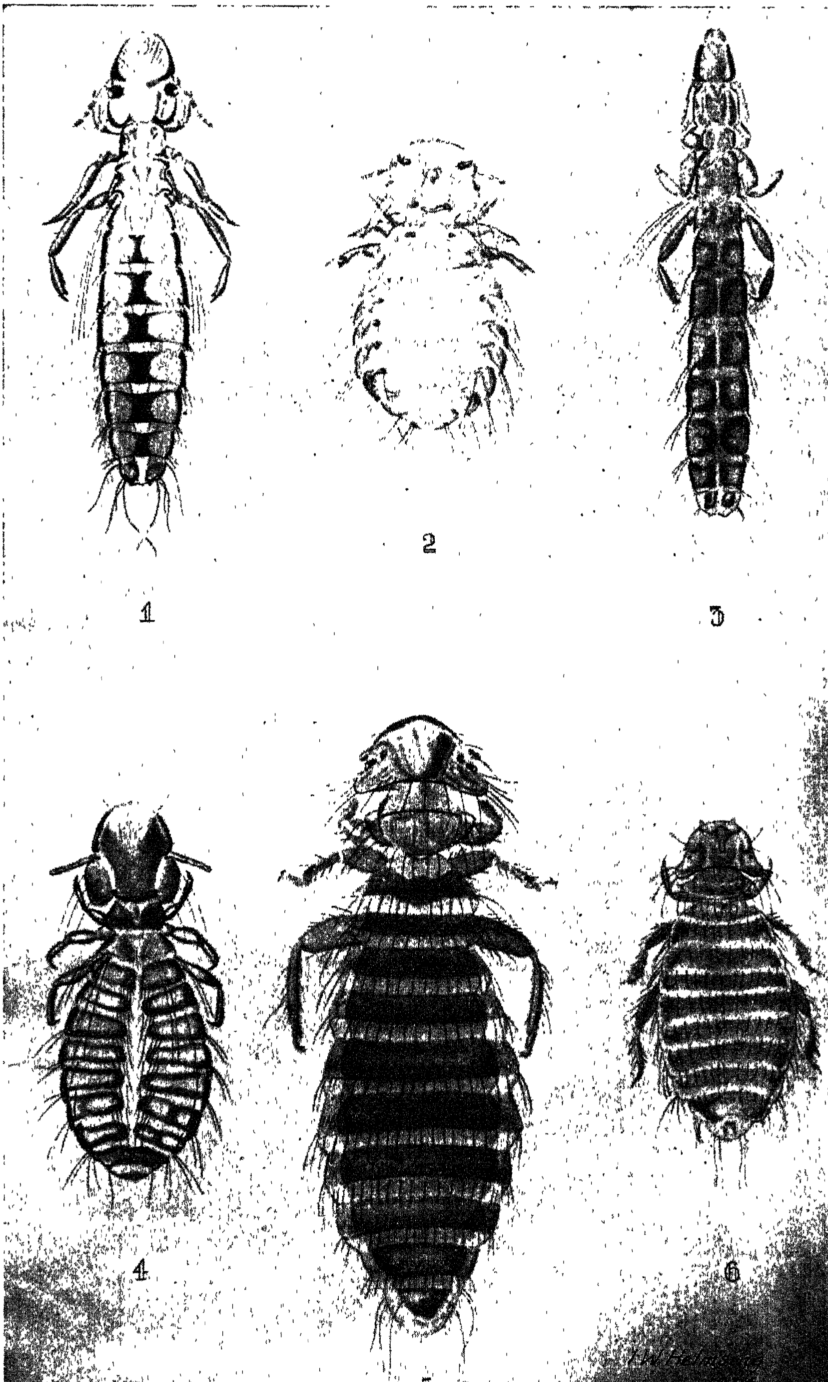


PLATE 231.—POULTRY LICE.

(*For description of Plate see page 562.*)

The two most important lice are the head louse, *Lipeurus heterographus* (Plate 231, fig. 4), and the body louse, *Eomenocanthus stramineus* (Plate 231, fig. 6). The former occurs in the region of the head, and is distinctly injurious to young chicks, and on occasions even to grown fowls. The body louse occurs mainly on grown fowls and causes serious irritation, resulting in unthriftiness and a marked decrease in the egg yield.

Control of Lice.

Lice may be best controlled with sodium fluoride, used either as a powder or as a dip, one treatment, if carefully carried out, being sufficient to kill all lice and their eggs.

Used as a powder, sodium fluoride may be applied in pinches to the base of the feathers in the region of the head, neck, back, breast, vent, wings, tail, and thighs, or it may be mixed with flour in the proportion of three parts of flour to one part of sodium fluoride and applied by means of a shaker.

Where large numbers of fowls are concerned, it may be considered more convenient to apply the sodium fluoride in the form of a dip, 1 oz. to each gallon of water. Only warm, sunny days should be chosen for dipping, and the fowl is plunged into the dip with the wings outspread. The fluid is then worked into the feathers with the fingers and the head ducked once or twice.

THE TROPICAL FOWL MITE (Liponyssus bursa).

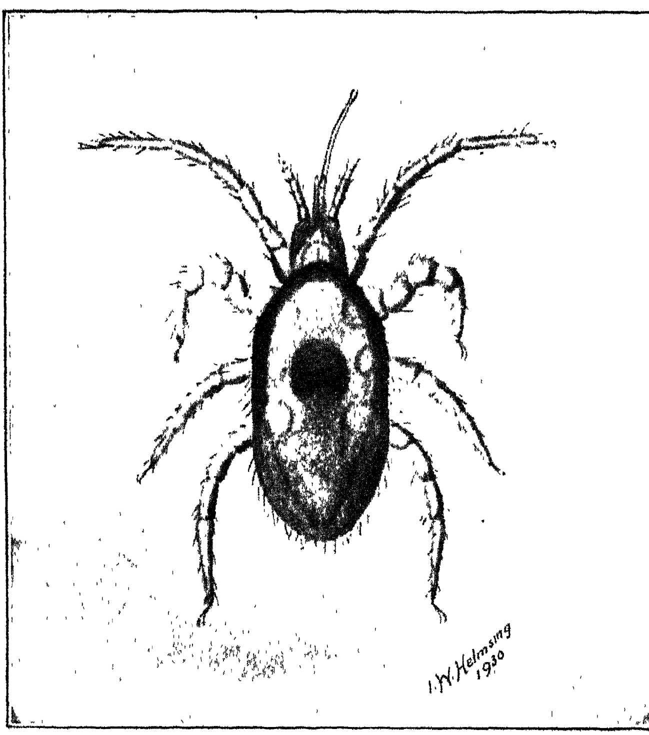


PLATE 232.—THE TROPICAL FOWL MITE (*Liponyssus bursa*).

This mite is very small in size, being no larger than a pin's head. It may be seen on poultry at any time during the day and night, and, owing to its bloodsucking habits, is distinctly injurious, especially to chickens and young poultry. Sitting hens may be so irritated by its presence as to leave the nest. On the fowl this mite occurs in greatest numbers below the vent, about the tail, and sometimes on the neck. A heavy infestation gives the feathers a dirty appearance, and the skin becomes irritated and scabby.

The female mite deposits her eggs among the feathers, where the young mites hatch and may complete their life cycle without leaving the fowl.

This is the species usually seen in fowlhouses in Queensland. When in numbers, the mites may crawl onto the arms, &c., of the poultryman, when handling infested fowls or nesting straw, and cause severe irritation. The tropical fowl mite may be transported by starlings, pigeons, and sparrows, and is also concerned with an infestation of houses, popularly held to be due to "starling lice."

Control.

Spraying with crude oil and the burning of all litter and nesting straw is advised. In addition, individual treatment of all fowls by dipping in a mixture of 1 gallon of water, 2 oz. of flowers of sulphur, and 1 oz. of soap is necessary, taking care to wet the feathers thoroughly. Alternatively, dusting with flowers of sulphur will be found satisfactory, but is not considered to be as efficient as dipping.

RED MITE (Dermanyssus gallinæ).

This mite is very similar to the tropical fowl mite in appearance, but, like the poultry tick, feeds only at night, and, with few exceptions —for example, in the case of sitting hens—is not found on the birds during the day. The red mite is also a bloodsucker, and when in numbers may be regarded as a serious parasite. Its eggs are laid in the cracks and crevices in which it hides by day.

Control.

Red mite control may be accomplished by spraying with crude oil and the destruction of all litter. Dipping in this case is not required. Spraying should be repeated every three days till no more mites are seen.

SCALY-LEG MITE (Cnemidocoptes mutans).

This itch mite, as its name implies, is responsible for a condition among poultry known as scaly-leg. Mite attack is usually confined to the legs, though occasionally it has been known to include the comb and wattles. The mites, burrowing in beneath the scales, cause the formation of large crusts. They usually commence their attack between the toes, and gradually extend up the unfeathered portion of the leg. In severe cases the birds become lame and walk with difficulty, and, being unable to scratch, may rapidly lose condition.

Control.

The mites spread mainly by contact or from the perches, so no hesitation should be shown in treating affected fowls. An effective remedy is crude oil, into which the legs are dipped and washed with

a hard brush. The treatment should be repeated after thirty days. The perches should also be painted with crude oil.

DEPLUMING MITE (Cnemidocoptes gallinæ).

This mite lives at the base of the feathers and causes an intense itching, as a result of which the affected bird pulls out the feathers. If the stumps of the feathers are examined, they will be found surrounded with scales and crusts, whose presence distinguishes depluming mite infestation from moulting or the vice of feather-picking.

Control.

Dipping in the mixtures used for tropical fowl mite control is recommended.

INTERNAL PARASITES.

Flukes, tapeworms, and roundworms occur in the domestic fowl, but in Queensland fluke infestation is as yet unknown.

TAPEWORMS.

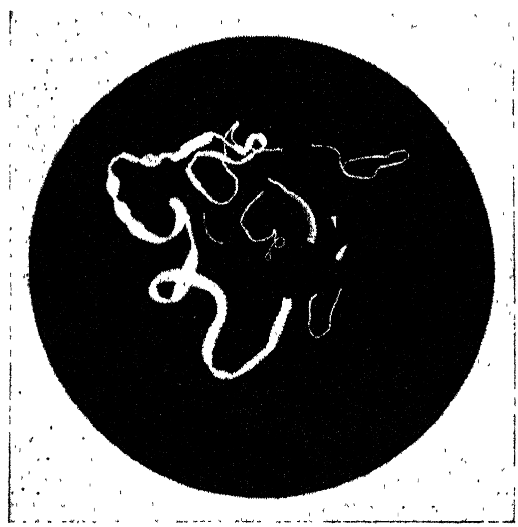


PLATE 233.

Different species of Tapeworms which are found in the fowl. (Natural size.)

Fowls in this State are infested with at least six distinct species of tapeworms, all of which occur in the intestine. The smallest of these, *Davainea proglottina,* is only about one-eighth of an inch in length, and is regarded as one of the most harmful tapeworms infesting the fowl. It occurs in the immediate anterior portion of the intestine, and requires various species of slugs in which to undergo part of its life cycle.

The largest tapeworm, *Davainea tetragona,* occurs in the lower portions of the intestine and may grow up to 10 inches in length. This species must undergo development in the housefly before its life cycle can be completed.

The other tapeworms infesting the fowl use various species of beetles, earthworms, and grasshoppers as intermediate hosts.

Effect of Tapeworm Infestation on the Fowl.

Heavy infestations are associated with loss of weight, diarrhœa, unthriftiness, and a decreased egg production, young fowls being most seriously affected. Some species, particularly *Davainea proglottina,* are considered by some authorities to cause leg weakness and leg paralysis.

Control.

The most efficient drug for the removal of tapeworms is Kamala. The dose for an adult bird is 1 gram, which should be reduced accordingly for younger birds and in cases of weakness. It is always best to treat individual birds and not attempt to give a mass treatment by mixing the drug with the food. No previous starvation is necessary. To be on the safe side, a few birds only should be treated at first and carefully watched for any ill-effects.

As poultry tapeworms require an intermediate host to complete their life cycle, and as these several intermediate hosts must come into contact with the dung before they become infected, the first step in prevention consists of the regular removal of all droppings and their safe disposal. The droppings should be either burnt or else treated with a strong disinfectant and buried. All litter which provides hiding-places for the beetles, &c., should be destroyed and everything possible done to do away with conditions favourable to the breeding of these intermediate hosts. Boards, stones, &c., are shelter for slugs and should be cleared away. Dampness is another factor favouring some of these intermediate hosts.

ROUNDWORMS.

Several species of roundworms occur in the domestic fowl, the majority of which are found in the alimentary canal.

THE LARGE ROUNDWORM (Ascaridia lineata).

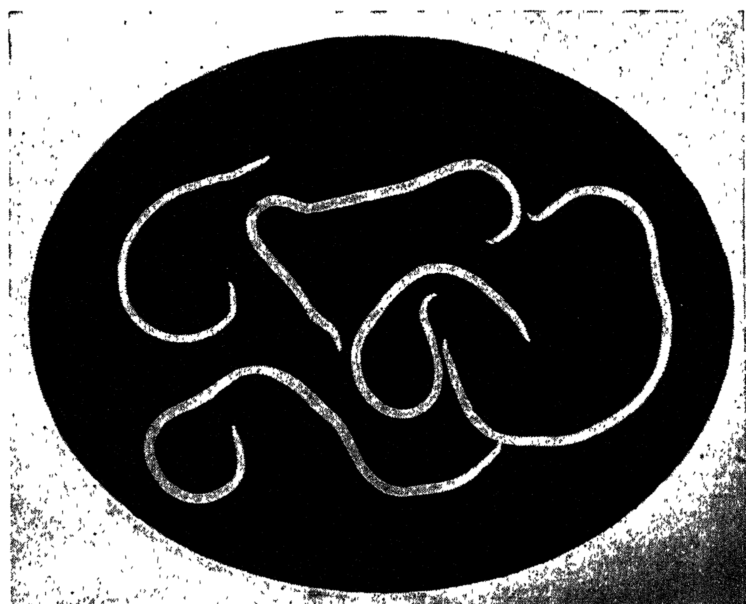


Plate 234.—The Large Roundworm (*Ascaridia lineata*). (Natural size.)

The cæcum worm is an extremely common parasite of the fowl, and is found in the cæcum or blind gut. This is a whitish species growing up to half an inch in length.

Under favourable conditions these roundworms may be present in large numbers in the cæca, sometimes causing, especially in young birds, a serious inflammatory condition of the cæcal walls.

Life History.

The eggs reach the soil in the droppings of infested birds, where under suitable conditions of temperature and moisture they may become infective in fourteen to seventeen days. When swallowed by the fowl, these infective eggs hatch in the small intestine. The tiny larvæ hatching from the eggs make their way to the cæca or blind gut, and in about twenty-four days are fully grown. It was once considered that these larvæ penetrated the cæcal walls, causing the formation of nodules, but recent work has shown that at no time do they leave the lumen of this or any other portion of the alimentary canal.

Control.

The tobacco dust treatment as recommended for the large roundworm is stated to be effective if continued for one month. The preventive measures as advised for this parasite are also recommended.

STOMACH WORM (Dispharynx spiralis).

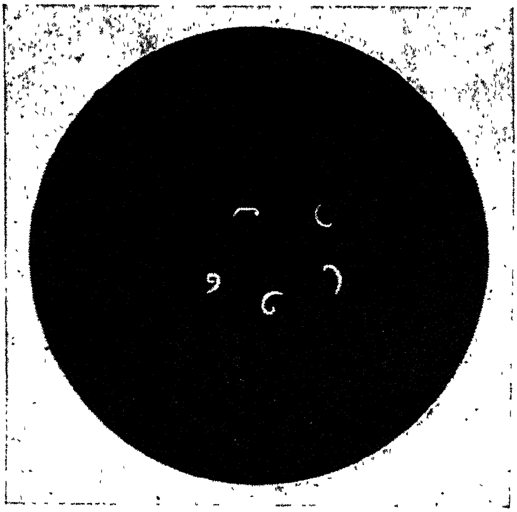


PLATE 237.—STOMACH WORM (*Dispharynx spiralis*). (Natural size.)

This species is a short, twisted worm, which occurs in the glandular stomach. It is not regarded as a very common parasite, but heavy infestations have been known to occur. When in large numbers, these worms may destroy the glands of the stomach, and in such instances infested birds, while maintaining a ravenous appetite, rapidly lose condition and may die.

Life History.

This stomach worm requires an intermediate host to complete its life history, and this role is played by the small, greyish, many-legged insect-like animals, known as wood lice or sow bugs. These are very conspicuous in damp places, where shelter is provided by piles of litter, loose boards, &c.

Control.

No satisfactory treatment is known, though the individual treatment as advised for the large roundworm should be tried. Strict sanitation must be enforced to prevent infection, and everything possible done to eliminate the presence of sow bugs on the runs, which may best be accomplished by keeping the place free of litter of all types.

GIZZARD WORM (Cheilospirura hamulosa).

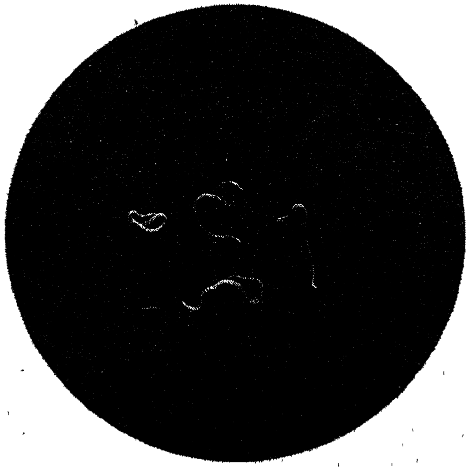


PLATE 238.—GIZZARD WORM (*Cheilospirura hamulosa*). (Natural size.)

If a gizzard infested with this roundworm is examined, numerous perforations and brownish areas may be detected on the horny lining. On stripping this lining, burrows will be seen in the muscle wall thus exposed, from which a portion of the worm may be protruding. These worms may grow up to three-quarters of an inch in length and, owing to their burrowing activities in the muscle wall, seriously interfere with the health of the fowl.

Life History.

In this case various species of grasshoppers must be present for the worm to undergo portion of its life cycle, the fowl becoming infected only when it eats these insects.

Control.

There is no treatment known, and control is entirely dependent upon the prompt removal of the droppings and their disposal so that they are not available to the intermediate host.

EYE WORM (Oxyspirura parvovum).

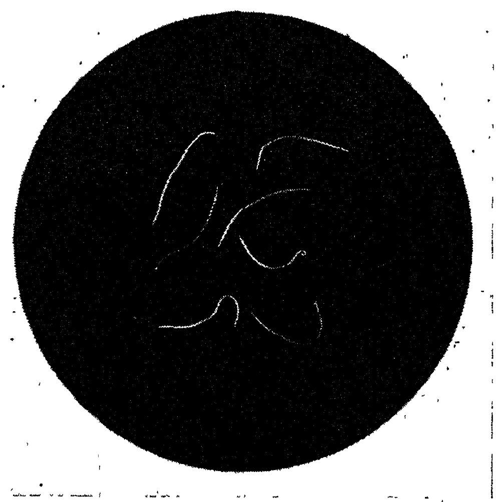


PLATE 239.—EYE WORM (*Oxyspirura parvovum*). (Natural size.)

The poultry eye worm is of interest only to poultry-keepers in North Queensland, as it is unknown south of Rockhampton.

This roundworm may grow up to three-quarters of an inch in length, and is found under the nictitating membrane* of the eye.

The presence of the eye worm causes irritation and inflammation of the eye, to relieve which infested fowls rub the eye against the wing or some other convenient part of the body, and may even scratch the eye with the foot. The eyelids may become inflamed and swollen, and there is a discharge from the eyes and nostrils. The sight is impaired, and if the infestation is not relieved blindness may result.

Life History.

The eggs laid by the female worms in the eye pass down the tear ducts into the throat, are swallowed, and eventually reach the exterior in the droppings. In time young worms hatch out, but before they can become infective to the fowl must be eaten by a species of cockroach. After a period of development in the cockroach, the young worms are ready to infest the fowl, which occurs when the cockroach is eaten. The worms free themselves from their insect host in the mouth of the bird and, passing up the tear ducts, reach the eyes.

Control.

For the removal of the worms from the eyes, a few drops of turpentine are placed in the eye and allowed to act for half an hour. The eyes are then washed in lukewarm boracic water and the worms removed with a camel-hair brush.

Prevention consists in the regular removal of all droppings and the elimination of all litter, &c., likely to provide hiding-places for cockroaches. The use of a good disinfectant as a spray will be found advantageous.

* The nictitating membrane is the thin membrane which pasees over the eye when the fowl blinks.

Balanitis in Sheep.

By K. S. McINTOSH, B.V.Sc., H.D.A., Government Veterinary Surgeon.

BALANITIS or "pizzle disease" commonly occurs amongst wethers, and is occasionally seen in rams. It is an inflammation of the sheath or prepuce with the formation of pus. Although non-contagious, it is not uncommon for a large number of sheep to be affected at the same time.

Cause.

To appreciate the cause of balanitis, it is necessary to know something of the anatomy of the part. The penis or pizzle of the sheep extends forwards along the belly to a point just behind the navel, where it ends in a worm-like or vermiform appendage. The free portion is encased in the sheath or prepuce, which is actually an inward fold of skin, being continuous with the skin of the penis. The interior of the prepuce is lined with a modified type of of skin, which does not bear wool or hairs, but has sebaceous glands which secrete a cheesy yolk-like substance. The opening of the prepuce is also situated a little behind the navel, and it is through this opening that the urine pours after emission from the penis.

As the urine of sheep is alkaline, it often contains a fair amount of gritty insoluble substance. When this is passed with the urine it mixes with the sebaceous material, and forms a tough, gritty mass in the prepuce, particularly near the end of the penis. This sets up a marked irritation of the parts, which in many cases is followed by the formation of pus, with swelling and inflammation.

In the case of rams, the penis is frequently protruded, and thus the deposit is not allowed to accumulate, but in wethers and young rams the penis is never protruded, and thus they urinate into the sheath. This is the reason why the disease is more prevelant in wethers and young rams.

If a tuft of wool is left at the opening at shearing time it forms an excellent site for the accumulation of grit and sebaceous material, and when cut with the blades one can feel the grit in the wool.

Removal of the long hairs at the opening during shearing is also a predisposing cause, as these hairs assist in the draining away of urine. Sometimes grass seeds will cause pizzle disease by penetrating the sheath or its opening and setting up pus formation.

Diagnosis and Course of the Disease.

Owing to irritation and pain the sheep becomes uneasy and frequently kicks at the belly as if fly-struck. Sometimes sheep will be seen attempting to bite the pizzle, or they may rub it on stumps, &c.

If left untreated the affected parts swell till finally the animal is unable to urinate. At this stage one of two things may happen: Firstly, the sheep may die owing to retention of urine; secondly, there may be gangrene and sloughing of portion of the affected part, and the sheep will urinate through an opening in the prepuce caused by the slough.

The condition is often accompanied by fly strike.

The sheep falls away in condition, and if treatment is not commenced in the early stages there may be appreciable losses.

Treatment.

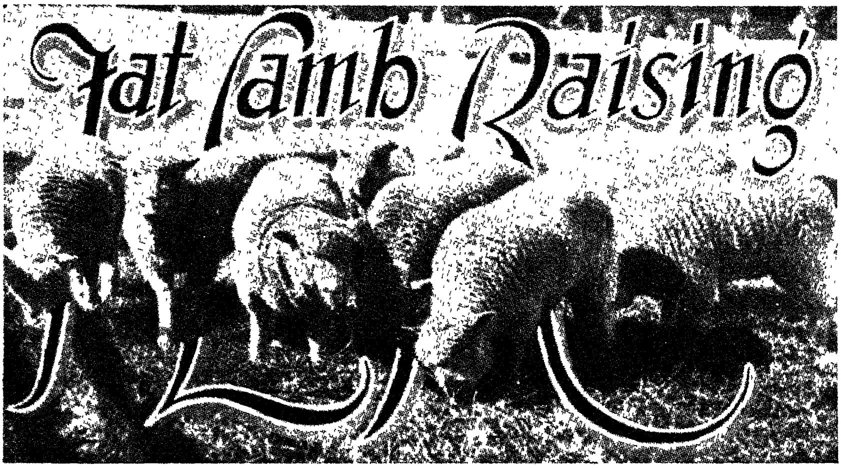
In the very early stages the disease may be treated by "ringing" the "pizzle," squeezing out the pus, and syringing the sheath with a lysol solution at the strength of one dessertspoonful to a pint of water. After this the sheath should be syringed every three or four days with a 2 per cent. solution of bluestone (copper sulphate).

In more advanced cases one has to slit open the sheath. This is most conveniently done with a long pair of scissors with one blunt point. The blunt (or ball) pointed blade is passed into the opening, and the prepuce cut open. Using a clean piece of rag and lysol solution, the pus, &c., is then cleaned away and the part washed. The wound must then be treated every two or three days till healed.

Between treatments the sheep should be placed in a well-grassed paddock.

Remember that the object of treatment is to clean away pus and dirt, and that cleanliness must be kept in mind throughout treatment.

Do not be in a hurry to open the prepuce of all sheep, but if they are not badly affected, try syringing first.



By JAS. CAREW.

FAT-LAMB raising should form part of the routine farming in parts of Queensland, where the cultivation of a variety of fodder crops and grain can be carried on successfully. This industry has never been carried on in a general way in Queensland, and only a few Darling Downs farmers have continued it over lengthy periods. Where the correct breed and type were used, good lambs have been produced and sent forward, and some of the lambs shown at the Brisbane Exhibition were prime for export. That many lambs sold in our markets are not prime for export is, however, a well-known fact, but this can hardly be otherwise when such a large percentage of them are pure Merino. Should we wish to develop successfully this important section of the sheep industry, it will be necessary to give full consideration to breeding, feeding, and marketing. We must be influenced in the breed we select by the demand for the dressed lamb in our most important markets, as well as by the influence of our local conditions in producing them.

The Importance of the Dam.

The type of breeding ewe is important, and must be considered from several aspects. The ideal for the purpose is the large-framed, roomy ewe, productive in milk and wool, that will give a high percentage of lambs, and, if possible, mate at suitable seasons of the year. This type is difficult to obtain, with the result that a beginning must be made with the best that are offering.

As a mother for raising fat lambs, the pure-bred Merino cannot be regarded to be as satisfactory in a general way as crossbreds or comebacks. Merinos are more careless as mothers, giving a smaller milk supply; besides, they do not fit in so conveniently in mixed farming practice. They do, however, compensate somewhat for these disadvantages, in so much as they will mate successfully both in spring and

autumn. Ewes of the British Long-wool-Merino cross mate more successfully in the autumn, and as the best price is usually obtained for the lamb that is fit for slaughter in August, September, and early October, the Merino will secure this advantage; but it should be of the strong robust Western type. The value of the Merino covering must also be taken into account, while their condition remains more in keeping with requirements for breeding purposes.

The half-bred Downs Merino ewe will also mate successfully in the early summer, as well as in the autumn; and on this account is deserving of consideration, for a high percentage of lambs can usually be expected. Here, again, another disadvantage is introduced, for in good seasons the ewes not carrying lambs are inclined to develop too much condition, while at all times they do not carry a profitable fleece.

A Suitable Cross.

By crossing the Lincoln, Romney Marsh, English Leicester, or Border Leicester with the Merino, a most suitable type of ewe will be secured for autumn mating.

Preference may be given to the Romney Marsh cross for the lower and damper country, and to the Border Leicester cross for the higher or plateau areas like the Darling Downs.

These crosses produce a good lengthy fleece of wool, which usually meets with a good demand. They come to maturity fairly early, are good milk-producers, easily handled, and when mated to a quick-maturing breed of ram, the lamb should be sold off the teat, provided suitable food is available.

Export Trade Requirements.

To obtain best results for export lambs, evenness of type must be produced; and as the sires have the greater influence in this respect, we should choose that which is most likely to meet the demand. At the present time, the lamb most eagerly sought after is that weighing from 32 to 30 lb., and even lower.

To meet this demand the Downs types are the most likely to show plumpness at this weight, which they should reach in three months under favourable conditions. Although this is the size and type to secure top prices, other carcasses of the larger type do not fall away to any great extent at price per lb., such as the longer carcass of a Romney Marsh or Border Leicester cross, which should dress 38 lb. at four and a-half months. Should the season be unfavourable and lambs require to be kept over, the value of the covering they produce has an important bearing on the business. To get best results it is necessary that all growers produce an even type for export, and these should carry a special brand or tag to indicate standard excellence. Here is a suitable suggestion for a brand:—Darling Downs, Queensland, or DD over Q, to indicate the early plump prime light weight; and ED over Q to indicate the English long-wool influence in the heavyweight lambs. Lambs over 38 lb. dressed weight are not in keen demand for export; therefore, the seasons and provision for fattening are important factors in successful fat-lamb raising.

Even when breeding on proper lines, the only way to secure and place prime lambs on the market is to give them a good start off and keep them going with plenty of good and suitable food right up to the time they are trucked for slaughter.

Suitable Fodder Crops.

To secure best results, the pasture must be good, succulent, and plentiful.

This is seldom present for sufficient duration in our forest country pastures, therefore we must associate fat-lamb raising with agriculture, or adapt the slogan "The lamb must follow the plough."

Crops must be timed for use in the fattening of lambs, which in turn is governed by the mating period. Full consideration must be given to all influences likely to have a bearing on the position. The class of crop suitable to the soil and conditions and the time of year must be taken into account.

If lucerne can be grown successfully, it will be found the best for the main supply for most of the year. It gives best results when associated with grass pasture, adding some grain when finishing off.

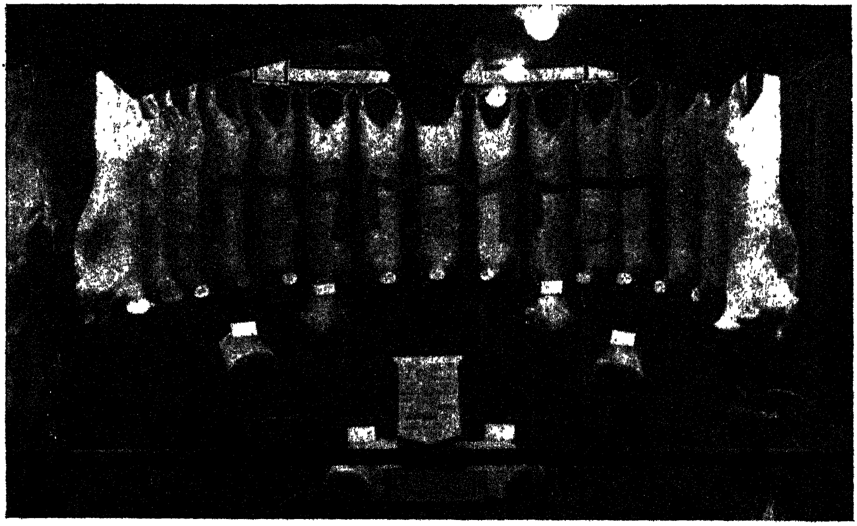


PLATE 240.—DISPLAY OF DARLING DOWNS LAMB CARCASES.
[*Block by courtesy of Queensland Meat Industry Board.*

Other crops suitable for given seasons are wheat, oats, barley, canary, rape, turnips, &c., for autumn sowing, and the panicums, millets, and Sudan grass for summer feeding and stacking.

When lambs are well fed and quickly fattened, they will be prime, plump, and sappy. In that condition they cannot be expected to stand up to hardship; therefore quick transport and immediate treatment at the works are two of the most important factors in avoiding serious loss of weight, and in maintaining the appearance of carcasses when dressed. If lambs on transport are to be man-handled, they should not be scruffed but lifted by securing a proper hold; any treatment likely to leave a bruise on the carcass should be avoided.

In obtaining the most satisfactory results, the co-operation of the Queensland Meat Industry Board and local agents is, no doubt, assured.

If numbers increase to anything near what Queensland is capable of producing, systematic forwarding will be necessary, and arrangements should be completed with the abattoirs before forwarding.

Preparation of Wool for Market.

TREATMENT OF BAGS AND BUTTS.

THE disposal of bags and butts is a problem that has always been in evidence, and even in the best of large clips the difficulty is encountered. Every broker at every sale has bags and butts which he wishes to sell to best advantage, and would be more satisfied without them. A duty to the client causes the broker to secure the highest possible price, but this is never likely to be in keeping with its true value, as the bags and butts are sought after by speculators only. As they are purchased for reclassing and reselling, it cannot be expected that their true value could be given, but rather that they be secured at the lowest possible price. Large owners are pleased to get rid of them with the least amount of trouble; therefore, when consigning their clip the bags and butts are included, except in cases where the odd lots are placed in bar bales. Bar bales are more objectionable to the broker than bags and butts; therefore, the difficulty is a real one. One of the most satisfactory methods would be to treat them on a large pooling floor where sufficient are put together to form bulk lines. This would be a distinct advantage to the small grower who does not grow sufficient wool to class it into bales, let alone bulk lines; while the large grower would also benefit. There is no question about the advantage of placing as much wool as possible on the market in bulk lines, and if not in bulk lines, then in bales. Bulk lines—five bales and over—are offered in the general catalogue and auctioned where all big buyers operate, while four bales and under are sold under star lot and competitive conditions, each system being distinct to the sale of bags and butts, which are really sold by barter.

In order to secure for all growers the best method of placing their wool on the market, the Department of Agriculture and Stock has so extended the conditions of the Farmers' Wool Scheme as to include—(*a*) wool from crossbred and British breeds from any holding; (*b*) bags and butts from any holding. This will allow that any grower may, with the consent of the owner, forward bags and butts for classification at the Departmental Wool Store.

With a view to securing an advantage for all wool-growers without causing an injustice to wool-brokers, it has been arranged that all brokers sell the wool from the scheme in turn. The drawing which the brokers themselves conducted recently resulted in the Queensland Primary Producers' Association, Limited, securing the agency for the season 1934-35. It now rests with the growers themselves as to whether they take advantage of the facilities that are placed at their disposal. The scheme is under the control of the Department of Agriculture and Stock, and the classing is carried out by qualified officers, while qualified accountants look after the bookkeeping part of the business.

Tuberculosis in Dairy Cattle and Pigs.

By J. C. J. MAUNDER, B.V.Sc.

THE influence of dairy cattle in the transmission of tuberculosis to pigs, resulting in partial and complete condemnations of carcases, is universally recognised. Much confusion seems to exist, however, concerning the relative importance of the various channels of infection.

The popular belief is undoubtedly that milk from infected cows fed to pigs is the most important source of infection. Actually, in conditions under which pig-raising is carried out in Queensland, milk infection is of minor importance compared to the degree of infection caused by ingestion of materials contaminated by dung of tuberculous cattle.

Consideration of the following facts will explain the relative importance of milk infection and infection from body excretions:—

It is well known that a cow with tuberculous lesions of the udder will excrete the organisms in the milk; in addition any tuberculous animal, though udder is healthy, is likely to intermittently excrete the bacillus in the milk. Personal observations obtained from tuberculin testing and post-morten examination of reactors has revealed the fact that the percentage of udder lesions is small, not exceeding 2 per cent. of tuberculous animals. Therefore, approximately 98 per cent. tuberculous animals merely excrete the organism in milk at irregular intervals, some infected animals never excreting the organism in the milk.

Before tuberculous infection becomes established in a pig repeated ingestion of infective material is necessary. Intermittent ingestion of organisms can usually be countered by the natural body defences, and possibly increases the resistance of the animal to the disease.

In considering the importance of excretion of the bacillus in the dung of tuberculous cattle, the following facts should be studied:—

(1) Infective sputum in cases of pulmonary tuberculosis is coughed up and swallowed by the beast, reaching the intestinal tract and being excreted in the dung, the organisms retaining their virulence.

(2) Bile of infected animals is often found to contain the bacillus, the source either being lesions of the liver or organisms in the blood stream eliminated through the liver and evacuated with the bile through the intestine.

(3) Intestinal and peritoneal lesions are responsible for the evacuation of bacilli in the dung.

When it is considered that the vast majority of cattle affected with tuberculosis have lesions in either lungs, lympathic glands, pleura, peritoneum, or liver, it will be realised that this group evacuating the bacillus in the dung must constitute a greater menace than the 2 per cent. of udder infections excreting the organisms in the milk. In addition to the presence of the tubercle bacillus in dung of affected animals the organism may be evacuated with the urine when lesions are present in kidney, pelvic lymphatic glands or genital organs.

Assuming then that dung of infected animals, or material contaminated with dung, and, to a lesser extent urine, constitutes a greater menace of tuberculous infection of pigs than the ingestion of milk from tuberculous animals, evidence is produced in support of the belief.

Investigation of properties from which pig condemnations have been heavy always reveals the fact that young pigs are allowed free access to areas soiled by droppings of dairy cattle.

One interesting case is quoted. A dairy farmer had for some years suffered heavy losses from pig condemnations. Assuming the source of infection was milk from tuberculous cows he decided to feed only thoroughly-boiled milk to his pigs. In the batches of pigs that had been fed only on boiled milk condemnations showed not the slightest diminution. Therefore, a definite source of infection existed apart from the milk supply. A survey of the herd was made, suspicious cattle destroyed, and methods adopted to ensure that young pigs were not allowed access to areas soiled by droppings from the dairy cattle. Milk was fed without boiling and the condemnations of these pigs were nil. This particular farmer has since adhered to the practice of enclosing of pigs with excellent results.

Another case is worthy of recording.

An owner conducted four farms, the cattle for the four farms being drawn from a common source. Careful periodical inspection and culling revealed that each herd contained from time to time tuberculous beasts. Hence, on each farm, there existed the danger that pigs would contract the infection. Actually, over a period of years, condemnations were always confined to one farm only, and investigation showed that this was the only farm on which pigs were allowed access to areas contaminated by droppings of dairy cattle. Examination of the cattle showed that the health of the cattle in the four herds was of an even standard.

It would appear, after consideration of the incidence of tuberculous lesions in various organs of dairy cattle and the means of excretion of the organisms, and field observations, that material contaminated by dung from tuberculous animals constitutes a greater menace to the health of pigs than does milk from infected cows.

In further consideration of the problem, the feeding habits of young pigs should be observed. Notice how the pigs roam around nosing under dried clumps of manure, seeking the small green shoots of grass and herbage. The tubercle bacillus present in the dung from affected cows has been existing under conditions ideal for the maintenance of its virulence, that is moisture and protection from light. There is, therefore, great danger of infection of scavenging pigs with virulent organisms.

When cattle have been fed on whole corn a proportion of the corn is passed out unchanged and forms a great attraction for the pigs. In picking out the grain from the manure there is great danger of infection with organisms excreted from a tuberculous beast. Young pigs having access to offal of animals slaughtered is also most undesirable, while the practice of slaughtering diseased cattle and feeding to the pigs is disastrous.

Methods of Dealing with the Problem of Condemnations in Pigs.

1. Where condemnations have been heavy over a long period, it is desirable to make a survey of the entire herd, selecting any suspicious beasts for the application of the tuberculin test. Selection of such beasts should be guided by the following clinical symptoms:—

(*a*) Deep distressing cough, sides heaving, tongue protruded.

(*b*) Difficult, snoring respiration.

(*c*) General delibity, staring coat, dull, sunken eye, the whole giving an impression of a sick animal, reluctant to move about.

(*d*) Enlarged lymphatic glands of head and neck, pre-scapular, pre-crural and mammary regions.

(*e*) Falling away in condition following calving.

(*f*) Large swellings in the udder, usually high up at the back.

(*g*) One or more quarters not functioning.

(*h*) Muco-purulent nasal discharge periodically expelled by violent snorting.

In addition to the above select the offspring of an animal known to have been tuberculous.

By the selection of cattle as outlined, submission to the tuberculin test, slaughter and burning of reactors the herd can be cleaned of animals most likely to have been the source of the trouble.

It is well known that cattle may be tuberculous to a considerable extent and exhibit no symptoms, and it is likely that such cattle would still remain in the herd after selection.

Infection from such cattle is effectively prevented by strict enclosure of young pigs from time of birth until marketed, thus preventing access to infective droppings and material contaminated by same.

2. Where it is not possible to have the tuberculin test applied, culling of animals exhibiting the symptoms outlined, and enclosure of pigs will yield good results. However, this method, i.e., dispersal with tuberculin test, is likely to result in culling of non-tuberculous animals.

3. Where condemnations are light, consisting chiefly of heads with only an occasional carcase, it will often be impossible to select any really suspicious beast that may be responsible. In such cases, excellent results are obtained by simply paying attention to the complete enclosure of the pigs.

4. Application of the tuberculin test to the entire herd with slaughter of reactors is the surest method of eliminating tuberculosis in the pigs. However, it is often impracticable to pursue this course on account of the severe economic loss that may be entailed. In addition some reacting animals with very light infection and not in any way responsible for transmission to pigs would be destroyed.

Occasionally the condemnation of carcases cannot be traced to the dairy cattle as the source of the tubercular infection. Under such circumstances the brood sows may be responsible, though actually such

is rarely the case. When brood sows are solely responsible for condemnations, it is not difficult to diagnose due to the fact that the sow will exhibit rather marked symptoms. Chief of these are swellings in the head and neck region, sometimes discharging; marked digestive disturbances leading to emaciation; short dry cough later becoming distressed with difficult breathing; swollen joints which may discharge cheesy purulent masses.

The mere fact that although sows are often suspected and slaughtered they are usually found to be healthy, rather supports the belief that the milk from the dairy herd is not responsible for tuberculosis of the young pigs. Should the milk be solely responsible for all the condemnations of pigs for tuberculosis, surely it is obvious that brood sows in piggeries suffering condemnations would, despite greater resistance due to age and repeated light infections that had been overcome, also contract the infection , and within a year or two the majority of brood sows would be suffering from advanced tuberculosis leading to occasional deaths.

One additional source of infection worthy of mention is the poultry.

Pigs are susceptible to the strain of the tubercle bacillus causing the disease in poultry, and it should be remembered that tuberculous poultry excreting in pig pens are capable of transmitting the infection to pigs.

Fortunately avian tuberculosis, as far as has been determined, is of rare occurrence in Queensland. Hence, this source of infection is not so important as in other countries.

Summary.

1. The source of practically all tuberculosis in pigs in Queensland is the dairy cow.

2. Infection of pigs takes place chiefly—

(*a*) By ingestion of infective milk;

(*b*) By ingestion of material contaminated by infective droppings.

3. Infection by ingestion of material contaminated by infective dung is of greatest importance under conditions of pig-raising usually practised in this State.

4. Attention to health of the cattle, and complete enclosure of pigs preventing danger of ingestion of contaminated material will result in the elimination of persistent condemnation of tubercular carcases.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Queensland Weeds.

By C. T. WHITE, Government Botanist.

KHAKI WEED (*Alternanthera repens.*).

PLATE 241.

Description.—A creeping perennial herb, rooting at the nodes, stems hairy. Leaves opposite in unequal pairs, the one being usually much larger than the other, averaging about 1 inch long and $\frac{3}{4}$ inch wide, broadly obovate (i.e., inversely egg-shaped) in outline, apex with a minute spicule, base tapering to a more or less slender leaf-stalk. Flowers borne in great abundance in numerous heads in the leaf-axils; each flower surrounded by sharply pointed bracts, the whole head ripening in seed into a spiny burr. Seeds enclosed in loose membranous, easily detached skin (pericarp), light-brown in colour, smooth, round and flat, about one-sixteenth of an inch in diameter.

Distribution.—A native of tropical and subtropical America, now a naturalised weed in many warm countries. It is one of the most troublesome weeds in Queensland. It is very abundant in South Africa, and is supposed to have been introduced there from the Argentine in fodder at the time of the Boer War. From South Africa it is thought to have come to Australia, but how it came here is not definitely known.

Botanical Name.—*Alternanthera,* referring to the fertile anthers in some species of the genus alternating with sterile ones (staminodia); *repens,* Latin meaning creeping.

Common Name.—Khaki Weed or Khaki Burr is the general name given to the weed both here and in South Africa. I have generally regarded the name to be derived from the prevailing colour of the plant, particularly when drying off. A South African writer says, however, that the popular name, at least in that country, is due to the plant's association with the Boer War.

Eradication.—In small areas Khaki Weed is best destroyed by hand-grubbing or chipping, but as it has the power of sending out roots from the joints, there is always the chance, unless the work is carried out in hot, dry weather, of the cut pieces growing again, so that the cut-up plants should be raked up and burnt. In 1918 an officer of the Department of Agriculture and Stock, Mr. F. B. Smith, B.Sc., Assistant Agricultural Chemist, visited Beaudesert to inquire into the destruction of Khaki Weed by chemical means, and reported that the weed was easily destroyed by common salt (butcher's salt, or any coarse, common waste salt) at the rate of 1–2 tons per acre. A weak arsenical solution containing 0·2 per cent. arsenic will also be found effective where the poisonous spray could be used. The value of salt as a weed destroyer lies in its property of absorbing moisture both from the soil and plant tissues, and so kills the plant by thirst; thus to prove effective, it should be applied in hot, dry weather.

Botanical References.—*Alternanthera repens* (L.) O. Kuntze. In a letter from the Director, Royal Botanic Gardens, Kew, England (Sir Arthur W. Hill) under date 10th July, 1934, the above is given as the correct name for the common Khaki Weed of Queensland, with the following as synonyms:—*Achyranthes repens,* Linn. Sp. Pl. 205; *Illecebrum achyrantha* Linn.; *Alternanthera achyrantha* R. Br.; *Alternanthera echinata* Smith.

Nutritive Value of Pastures.

By E. H. GURNEY, Agricultural Chemist.*

WHEN it is considered that the major portion of the world's animal products utilised by man is dependent upon pasture, the great value of scientific investigation dealing with all the factors concerned with the growth of pasture must be recognised.

The value of the practical application of information obtained from such investigations should then also be recognised.

Until the last few years the study of pasture, together with other animal foodstuffs, was directed to the determination of Starch Equivalents, or Calories, and the "protein ratio," but it is now known that, in addition to these factors, there are others which are necessary to successful animal growth.

It would appear that green pasture of good nutritional value is supplied with vitamins, but these few remarks are made more in connection with the proteid and mineral content of pastures growing under different conditions and at different stages of growth.

Mention may be made that the value and functions of the mineral matter contained in foodstuffs is now more fully understood, and it has been proved that a number of stock ailments are caused through some mineral deficiency or incorrect mineral proportions in the food consumed.

The fact that fairly young grass growth is more nutritious feed for stock than the older rank growth has always been accepted, and in older settled countries, where the method of laying down pastures, is followed to an extensive degree that this fact was not overlooked is evidenced by the common practice of making hay of the pastures before it reaches the rank matured stage.

GRASSLAND MANAGEMENT.

The modern system of grassland management, though it is stated to have its origin in Germany in 1899 (A. W. Greenhill Jour. Agri. Science Vol. 20), has only been followed in the British Empire during the last decade. The present intensive system of rotational grazing consists of feeding off young pasture continuously, which is produced by grazing paddocks in rotation.

It must be understood that system differs essentially from the method of turning stock into different paddocks for purpose of feeding off any excessive grass growth.

The method of rotational grazing, which will be mentioned again, cannot, of course, be applied to the large grazing areas of pastoral holdings of the western districts, but grass growth in small paddocks might be protected and these paddocks used as nursery paddocks.

For the purpose of making quick comparison, the composition of grasses is stated as percentage of the dry material contained in the grass and any percentages quoted will have been calculated upon "water

* In a broadcast address to farmers from Radio Station 4QG.

free material.'' Thus a pasture containing 75 per cent. moisture and 25 per cent. dry material in which is included 5 per cent. protein, this amount of protein in 100 per cent. of dry or ''water free material'' would be 20 per cent.

The relatively long spells of dry weather occurring through the year in our climate has a great influence upon the feed value of our pastures. Rain falling after a spell of dry weather causes a very rapid grass growth, particularly so under warm weather conditions. The young flush growth of uncultivated natural grasses in the large grazing areas is only eaten by stock to a more or less limited extent, and what is not grazed off very rapidly reaches maturity. The young grass has, in most cases, a high feed value, considered both from its protein and mineral content; the amount of these food constituents varying somewhat according to conditions under which the grass has grown. But in all cases the feed value of the young grass decreases as growth towards maturity proceeds, and when the grass has reached the roughage stage the feed value is generally of a very low order.

The following figures from analyses of samples of Mitchell grass at different stages of growth are quoted in illustration:—

ANALYSIS OF WATER-FREE MATERIAL.

—	Crude Protein.	Crude Fibre.	Lime (CaO).	Phosphoric Acid (P_2O_5).	—
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Mitchell Grass ..	18·8	27·6	1·09	0·507	Young and green, 12 in. long;
ditto ..	8·2	32·4	0·55	0·310	seed ripe and falling;
ditto ..	2·3	36·3	0·56	0·066	more or less roughage.

From these figures the very great difference in the nutritive value of the grass at different stages of growth is very apparent. It should be mentioned that the different grasses of the western country are supplemented in good seasons and on good country by herbage, some of which is of very good feed value.

In discussing the pasture of the southern coastal areas different conditions exist, for here it is possible to control, to a large extent, both the kind of grass growing and its nutritive value. The pasture of coastal districts is principally utilised by dairy stock.

EXPANSION OF DAIRYING.

The dairy industry is expanding and competition is such that it is necessary for dairy products to be obtained as economically—and continuously—as possible, and it is for this reason that pasture management is so extensively practised in countries where dairying is to any extent conducted. Very briefly stated, pasture management in the coastal districts may be said to consist of sowing suitable grasses for the laying down of a permanent pasture, or the renovation of an existing pasture, and where the pasture is established by either of the abovementioned procedures. The next and most important step in pasture management is to feed off the pasture when in its most nutritious stage of growth, namely, when it is young and succulent. The feeding off of only young grass growth is managed by having the pasture subdivided into paddocks of about 2 to 3 acres, and grazing off these paddocks in rotation. Fertilizers are applied to these pastures.

The following figures show the increased nutritional value of pasture that has had fertilizer—ammonium sulphate and superphosphate—applied compared with similar adjacent unfertilized pasture:—

——	Crude Protein.	Crude Fibre.	Lime (CaO)	Phosphoric Acid (P_2O_5).
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Fertilized Pasture ..	17·6	25·9	0·593	0·586
Untreated Pasture ..	7·6	27·2	0·421	0·253

These figures show definitely the improved nutritional value of pasture gained through the application of fertilizers. The above samples were grown in paddocks at Caboolture, but similar improvement in pasture value has been obtained where correct fertilizer application and pasture management has taken place. It may be mentioned that the application of superphosphate increases closer growth in the pasture, whilst the ammonium sulphate particularly benefits grass growth.

The growth of legumes such as clover in grass pastures increases the feed value of such pastures, as the legumes generally are richer in both protein and minerals, being particularly rich in lime, but grasses grown under good conditions and grazed at best period of their growth contain usually somewhat more phosphoric acid than the legumes. It would appear from this that to obtain the best results a certain balance of clover and grass is necessary in pasture.

It is not necessary to give any further examples showing the great difference in the nutritive value of young and matured pasture. The following will illustrate the value of correct grass management, a sample of paspalum pasture obtained at time stock were put on it contained the following in the water-free material:—

	Per cent.
Crude Protein	21·1
Crude Fibre	26·3
Lime (CaO)	0·416
Phosphoric Acid (P_2O_5)	0·616

Sixty-four pounds of this green paspalum would supply 2·2 lb.. of digestible crude protein, which amount is sufficient for a cow yielding 25 lb. milk of 3·5 per cent. fat; whereas 67 lb. paspalum at a stage of growth frequently fed to cows require the addition of lucerne chaff or concentrates in order to supply the 2·2 lb. of protein required as mentioned. It is cheaper to supply protein in grass than to buy concentrates for that purpose.

It is possible with suitable grasses and correct management of the grasses to supply high-feeding value material, when other food material is lacking, either by grazing, the grass, or by using the surplus grass of flush growth, which has been stored as hay or ensilage.

NUTRIENTS IN STOCK FOODS.

In considering stock foods it is convenient to classify the different food nutrients, and a brief classification is as follows:—

Proteins are nitrogenous bodies contained in foods, and are used in the animal body for the purpose of building up the flesh and muscle

and for repairing what may be termed the waste of these organs which is continually taking place.

Carbohydrates, including such substances as sugars, starches, cellulose (fibre). These substances are used by the animal for the purpose of supplying heat and energy.

Fats and oils are also used for supplying heat and energy.

Mineral Matter.—Vitamins: The proteins, carbohydrates and fats are termed the organic matter, and the mineral matter (ash) is termed the inorganic matter of foods. It is in connection with the mineral matter of foods that a few remarks will be made.

Some sixty years ago an investigator named Voit and others pointed out the necessity of having supply of mineral matter in rations for animals, but the importance of this matter was not recognised until a few years back. It is interesting to note that disease in stock has been an important factor in directing attention to the necessity of having suitable amounts of mineral matter in stock foods.

The mineral matter of plants and animal life is composed of similar elements as calcium, sodium, potassium, magnesium, iron, phosphorus, sulphur, chlorine, iodine, and also traces of other elements.

It has been proved that these mineral elements are necessary for animal life, and, therefore, if normal healthy life is to be maintained these substances must be contained in the food.

In the past it was assumed that any apparently nutritious ration would supply mineral matter which was thought was only needed to build the skeleton of the body, but it is now known that all rations do not necessarily supply the required amount or correct proportion of the different mineral ingredients. Also, it is now known that mineral matter besides being necessary for bone formation is also necessary for blood and other fluids of the body, and the normal functioning of the organs of the body.

Taking the milk of an animal as being the best guide as to what are correct mineral requirements of the young growing animal, in the case of cow's milk it is found that about half of the total mineral matter of the milk is composed of calcium phosphate (lime phosphate). Again the greater portion of the bones is composed of phosphate of lime. Therefore, the food for the young growing animal requires to be well supplied with lime and phosphoric acid. The adult animal requires relatively less than the growing animal, but these mineral ingredients must still be in sufficient quantity for maintenance requirements.

Then, in addition, the adult lactating animal requires in the food sufficient lime and phosphoric acid to make good the loss of these minerals in the milk produced, particularly are these minerals necessary in ration of heavy milking cows.

From what has been said it will be noted that phosphoric acid and lime are the mineral ingredients required in the largest quantities by stock. This fact is of particular importance in this country as the soil of a considerable portion of our grazing areas, also of some of the cultivated soils, are deficient in phosphoric acid. In a previous talk the much higher lime and phosphoric acid content of young pasture growth than when pasture was more matured was mentioned.

In connection with the average lime and phosphoric acid content of a few common foodstuffs, the following are mentioned:—

	Lime (CaO). Per cent.	Phosphoric Acid (P_2O_5). Per cent.
Lucerne Hay	2·0	0·56
Paspalum Hay	0·5	0·38
Cowpea Hay	2·3	0·50
Green Sorghum	0·2	0·12
Bran	0·09	3·00
Pollard	0·08	2·10
Maize	0·02	0·70
Cotton Seed Meal	0·36	2·60
Linseed Meal	0·50	1·70
Coconut Cake	0·32	0·94

From these analyses it will be seen that bran and maize have a relatively low lime content, but bran and maize, cotton-seel meal, linseed meal, and coconut cake have a high phosphoric acid content. The legumes, lucerne and cowpea, have a high lime content, but the phosphoric acid content is not as high as in the bran, &c.

The green sorghum, in comparison with the other mentioned foodstuffs, has a low lime and phosphoric acid content.

Generally pasture contains more lime than phosphoric acid, and, as mentioned before, owing to a deficiency of phosphoric acid in soils, there is frequently a decided deficiency of phosphoric acid in the grasses grazed; and, therefore, giving lime only to the animals will not remedy troubles cause by phosphoric acid deficiency and, in fact, will only exaggerate such troubles.

The depraved taste exhibited at times by cattle in the chewing of bones, &c., is certainly an indication of the want of some mineral matter not supplied by the food, and generally it is insufficient phosphoric acid. Of the elements mentioned as being present in plants potassium is usually present in ample amounts for stock requirements, and so far as investigations have gone there would appear to be no evidence of iodine deficiency. The same may be said about iron and sulphur, though these ingredients administered to stock in small amounts prove beneficial to stock.

The sodium and chlorine are contained in plant growth, but in addition these elements are given to stock by means of common salt. Now, because animals require and must have a certain amount of salt for maintaining the digestive and other processes of the body, a somewhat common belief with some stock feeders is that if salt is given to stock that is all that is necessary to supply to correct any mineral deficiency in the food consumed by their stock.

From the few previous statements made it is apparent that salt will not supply the phosphoric acid deficiency frequently existing in our pastures.

The means available by which sufficient amounts of phosphoric acid may be supplied to stock are possibly well known, but are certainly not always practised.

Such means are (1) by cultivating and fertilizing pasture and then feeding this pasture off in the young stages of growth; (2) including in a ration some ingredients containing a fair amount of phosphoric acid; (3) by supplying stock with a good phosphatic lick, that is a lick containing a fair amount of phosphoric acid, and not an excessive amount of salt.

Some Requirements of Plant Growth.

By E. H. GURNEY, Agricultural Chemist.*

THE food of plants is naturally the first requirement to be considered in connection with plant growth.

Plants are composed of many compounds, these compounds being built up with chemical elements. The following elements are found in plants:—Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, calcium, potassium, magnesium, iron, sodium, silicon, manganese. Other elements are found in plants, some of which are now also considered as possibly being essential to plant growth.

Water, in so far as quantity is concerned, is the most important factor in plant production. The amount of water which enters the roots of plants and transpired through the leaves during growth is enormous. The amount will be realised when it is stated that for every pound of dry material manufactured by plant processes, from 300 to 800 lb. of water have been required. Of course, this amount of water represents the water that has circulated continuously through the plant carrying fresh amounts of dissolved food from the soil to meet the needs of the growing plant. In different crops the water required to produce one pound of dry matter varies considerably, thus it is stated wheat requires 500 lb., oats 600 lb., and clover 800 lb. of water to produce 1 lb. of dry plant material. Though the amount of water in the plant at any one time is large compared with other material composing the plant, it is relatively small when compared with the amount of water transpired.

Briefly, we may consider the composition of some crop—paspalum, for example—Water, 75 per cent.; organic matter, 22 per cent.; ash, 3 per cent.

Now practically one-half of the organic matter of plants consists of carbon, the rest of the organic matter being composed mostly of oxygen and hydrogen, and a small amount of nitrogen—about 0·4 per cent. The plants by means of the green colouring matter—chlorophyll—in their leaves have the power in sunlight of assimilating the carbon contained in the carbonic acid of the air. The air contains on the average 0·033 per cent., or one hundred of 1 per cent. of carbonic acid gas, and it is certainly very wonderful that about one-half of the dry matter of all green plant growth and coal in the world is the result of the assimilation by chlorophyll mentioned above.

Essentials of Successful Plant Development.

With this brief review of plant composition consideration can be given to means that may be employed to enable plants to obtain the requirements necessary for their most successful growth.

Plant life is assisted in connection with carbon assimilation in being situated in locations which permit of their receiving suitable exposure to sunlight, and this is one of the reasons that certain situations are more suitable than others for some crops.

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* In a broadcast address to farmers from Radio Station 4QG.

Here it may be mentioned that iron is necessary in plant life as it controls the formation of chlorophyll, and in some cases a deficiency of iron has caused a plant trouble termed "chlorosis." There is usually an abundant supply of iron in most soils, but in some cases where plant chlorosis has occurred owing to iron deficiency, the trouble has been rectified by the application of iron sulphate, either as a spray or to the soil.

Regarding the water requirement of plants, means are available for assisting plant growth in this requirement, and the first measure to be undertaken is to prepare the soil as far as possible into a suitable condition for the reception and retaining of rain. Rain falling upon a soil with its surface in a hard crust-like condition will be unable to penetrate the soil to the extent it would if soil surface was in a friable condition.

Some soils are able to retain the rain falling upon them better than others, and this is due to the fact that soils are composed of variable amounts of different materials. These various soil ingredients have very different power of absorbing and retaining water, thus soils having a high humus content and clayey soils have a much greater capacity of absorbing and retaining water than sandy soils. It has been found that a more or less pure sandy soil will only retain about 25 per cent. of its weight of water, whilst a sand clay may absorb as much as 50 per cent., and a soil with high humus content may absorb 85 per cent. or more.

It is considered that the most successful plant growth is obtained when the water content of the soil ranges from 40 to 50 per cent. of the total water-holding capacity of the soil.

Therefore, plants may be assisted in obtaining their suitable water requirements, first, by improving the condition of soil by converting it into a more open and friable condition by cultivation and liming, and in the second place by increasing the humus content of the soil.

Humus can be added to the soil by the addition of farmyard manure and by ploughing in green manure crops and all vegetable residues. In our climate, with at times long spells of dry weather, the necessity of increasing the humus content of soils for the purpose of retaining the soil moisture as long as possible is gradually becoming recognised, though not to the extent that its importance deserves, but as farmyard manure is not available in large quantity, the ploughing in of green manure crops should be a regular procedure in our cultural system.

It was mentioned that the organic matter of the paspalum contained a certain amount of nitrogen; similarly all plant life contains nitrogen, the percentage of nitrogen being much higher in the younger stages of plant growth than in the matured plant. Some plants contain more nitrogen than others. Thus leguminous crops have a high nitrogen content, and what is of particular importance is that the nitrogen of these crops is derived from the air, and thus the growth of a leguminous crop does not lessen the soil's nitrogen content, but increases it. This valuable property of the legumes is due to the fact that the various leguminous crops have different bacteria growing in "symbiosis" with them (symbiosis means the living together of two organisms for their mutual benefit).

The bacteria enter the roots of the plant, which results in the formation of nodules upon the roots, after which the bacteria obtaining energy from plant material converts the nitrogen of the air in the soil into compounds suitable for assimilation by the plant. For this reason legumes are particularly suitable as green manure crops, although other crop growths are valuable for this purpose.

Value of Humus.

It may again be stated that it is considered that in Queensland one very important means of maintaining the fertility of agricultural fields or garden plots is by the continued application of material capable of forming humus. That this application of humus may not supply all the mineral plant-food requirements is admitted, but humus in the soil assists in rendering more quickly available to plants the mineral plant-food applied by means of fertilisers. That mineral plant-food material is required by plants is shown by the composition of plant growth previously mentioned and is represented by the ash.

For the most successful plant growth there are requirements besides a sufficiency of moisture and plant foods. Some crops, such as clover, peas, cherries, thrive on soils that are not of an acid nature, whereas other crops such as maize have been grown successfully on soils having at least some degree of acidity. Again the different types of soils are more suitable for different plant growth, sandy loams being more suitable for root development of some crops than soils of a more clayey nature.

That crops have not made successful growth does not necessarily mean that some plant food is wanting or is in too small quantities, though this is very frequently assumed, whereas the real reason of poor growth may be that the type of soil is not suitable for the crop sown in it, or that the soil requires proper drainage, or that the soil has not a suitable aspect for the crop in question.

Therefore, in conclusion, it may be said for all crop requirements it is necessary to have all soil conditions such as tilth, available plant food, and soil bacterial population in good condition to satisfy their requirements.

FERTILIZERS AND MANURES.

Crops obtain their mineral plant-food requirements from the soil water. Cultivated soils usually contain abundance of plant food for many successive crops, with the possible exception of three or four substances—viz., nitrogen, phosphoric acid, potash, and lime. These substances in a fertile soil are not only present, but supplies are present in a form sufficiently available for the crop's need, whereas an infertile soil may contain the abovementioned food materials in a form unavailable to crops. Fertilizers and manures are applied to the soil to provide a certain amount of these plant foods to crops.

Fertilizers, often spoken of as artificial fertilizers, is the name given to what may be termed manufactured materials used for the purpose of supplying plant food to crops, and the term manure is more used in reference to such material as farmyard manure, guanos, and bulky organic material, which manures, it may be mentioned, improve the physical and biological conditions of the soils as well as supplying plant food.

Soils become depleted of some portion of their plant food by incorrect systems of cultivation; the supply of some particular plant food is exhausted before others. What particular plant food is required to be supplemented with application of fertilizer can be determined by experimental plots with crop it is intended to grow. Different crops require varying proportions of the different plant foods, some requiring larger amounts of nitrogen, others demand more phosphoric acid or potash.

The general effect upon plant life of the different ingredients in fertilizers should be considered.

Nitrogen stimulates the growth of the stems and foliage of plants, and if excessive amounts of nitrogen are applied, particularly if a deficiency of phosphoric acid and potash exists, very vigorous plant growth occurs, but with poor development of flowers and fruit.

Phosphoric acid promotes the growth of roots, increases crop yields, and accelerates the ripening and maturity of crops.

Potash seems to be connected with the formation of starch and sugar in plants, and in some cases with increased crop yield. Potash deficiency causes plant growth to be less resistant to diseases.

Lime improves soil tilth, renders some unavailable soil plant food to become available, causes conditions favourable for bacterial growth, and neutralises soil acidity. As in most soils there is sufficient lime for plant food requirements, lime is applied for the purposes just mentioned and not for plant food.

All plants make use of the same plant foods, but different plants require different proportions of these food ingredients.

These plant foods ingredients are contained in different commercial fertilizers. Among what may be termed simple (that is containing only one food ingredient) nitrogenous fertilizers are nitrate of soda, containing 15 per cent. nitrogen, ammonium sulphate, with 21 per cent. nitrogen. Both of these fertilizers being water-soluble are quick acting, the ammonium sulphate being somewhat slower than nitrate of soda. It is considered that plants when taking up nitrogen from the soil water assimilate the greater portion of their nitrogen in the form of nitrates, and, therefore, that the nitrogen in the ammonium sulphate is changed by reactions in the soil to the nitrate form before being utilised by the plant. Dried blood is another nitrogenous manure containing from 11 to 12 per cent. nitrogen. The nitrogen in this fertilizer is not so quickly available as the nitrogen in the two previously-mentioned fertilizers, still dried blood may be classed as a fairly quick-acting fertilizer.

Two simple phosphatic fertilizers are superphosphate and Nauru phosphate. Superphosphate containing from 20 to 21 per cent. phosphoric acid in a water soluble form is a quick-acting fertilizer, whereas Nauru phosphate containing from 37 to 38 per cent. of phosphoric acid in a form insoluble in water, is a slow-acting fertilizer, particularly if it is not ground to a fine state of division. In fact results from the application of Nauru phosphate are frequently not noticed during the first year, but appear in the second year.

Potash is contained in the two fertilizers sulphate and muriate of potash. Both these fertilizers being soluble in water are very quick

acting. The sulphate contains 48 per cent. and the muriate 50 per cent. potash.

Bonedust contains two fertilizing ingredients—viz., from about 3 to 4 per cent. nitrogen, and from 20 to 25 per cent. phosphoric acid. Meatworks fertilizer also contains from 3 to 7 per cent. nitrogen and from 14 to 20 per cent. phosphoric acid, and as these fertilizers have to be first decomposed in the soil their nitrogen and phosphoric acid only slowly become available.

Mixed or complete fertilizers, of which there are many upon the market, are those fertilizers which are manufactured by mixing any two or more simple fertilizers together. These complete fertilizers are known and sold under trade names or number, or with formulæ such as 6-14-10, which means the fertilizer contains 6 per cent. nitrogen, 14 per cent. phosphoric acid, and 10 per cent. potash, and another example 0-14-8 means that such a fertilizer contains no nitrogen, 14 per cent. phosphoric acid, and 8 per cent. potash.

POINTS IN FERTILIZING PRACTICE.

In connection with the fertilizers previously mentioned, it was stated that some were "quick acting" others again were "slow acting" and this difference in the time taken before the fertilizing ingredient is in a condition suitable for absorption by the plant is of particular practical value. In the case of crops that occupy the ground for more or less long periods it is advisable to apply fertilizers in which the fertilizing ingredients gradually become available to the plants, or under some soil conditions it may be advisable to apply a fertilizer in which portion of the ingredients are quickly available and the other portion slowly available. For crops that come quickly to maturity quick-acting fertilizers are required in order that a plentiful supply of available food is provided. Again it is frequently required that at some particular stage of growth the crops are advantageously stimulated by some quick-acting fertilizing ingredient, and hence the practice of top-dressings. A very good example of the stimulating effect of a quick-acting fertilizer is seen in the modern practice of pasture cultivation, in which at first the pasture is fertilized with ammonium sulphate and superphosphate either without or with potash, then throughout the season topdressing with ammonium sulphate results in very definite increased grass growth.

Another point in connection with fertilizers is that some crops respond better to their application when their fertilizing ingredient is of organic nature and not mineral. In applying fertilizers to pineapples it is generally stated that it is preferable to apply the nitrogen required in the organic form—viz., in blood and meatworks manure (blood and bone) and not in nitrate of soda (the mineral form). The nature of the fertilizing ingredients in the complete fertilizers sold can always be ascertained as it is stated in what form they exist—thus nitrogen as blood or as ammonium sulphate—phosphoric acid as bone or as superphosphate.

Lime, as stated before, is usually used for the purpose of improving tilth, neutralising acidity, and liberating otherwise insoluble plant foods. Lime can be used in different forms—viz., as quick lime, agricultural lime, and pulverised limestone. Quick lime is recommended for use on stiff, heavy soils, whilst the use of pulverised limestone is preferable on

lighter sandy soils with low humus content. The pulverised limestone to be effective must be in a very fine state of division. The degree of fineness is of importance in connection with such fertilizers as bone, Nauru phosphate, &c., for the finer the state of division of such fertilizers the quicker do they become available to plants.

It must be distinctly recognised that success from the application of fertilizers cannot be obtained, if the soil to which they are applied is in any manner of bad condition, such as bad tilth, poor drainage, or poor bacterial condition. This last condition is of particular importance in connection with the effect of fertilizers.

Fertilizers are always more effective if applied in conjunction with farmyard manure, even if with only small amounts of farmyard manure, as such manure encourages bacterial activity which in turn assists in converting more quickly the fertilizers into an available form for plants.

In connection with manures, such as farmyard manures, green manure crops, and composted vegetable matter, it may be said that they are used particularly for supplying humus to the soil and thus improving the physical and biological conditions of the soil, but such manures depending upon particular soil condition and crop requirement, may or may not be able to supply the particular amount of any mineral plant food required.

In connection with farmyard manure, it is considered that its importance is not properly recognised, as by not being collected and ploughed into the soil or stacked, a very great waste of valuable material results. The composition of farmyard manure varies considerably, but 1 ton of mixed farmyard manure contains from 450 to 700 lb. of organic matter, 10 to 15 lb. of nitrogen, 3 to 6 lb. of phosphoric acid, and from 8 to 16 lb. of potash. Then neglect of composting waste vegetable matter also ensures the loss of very valuable material which is of particular use in orchards and market gardens. Regarding green manure crops, the composition of which varies very much according to the kind of crop used, but, besides a very large amount of organic matter which such crops return to the soil it must be remembered that the plant food material contained in such crops is in a very available condition. Of course it must not be overlooked that these plant foods, with the exception of the bulk of the organic matter, are taken from the soil and thus do not correspond to the actual addition of chemical manure, but, as previously stated, are of great value as they are in a very available form. Thus the amount of material returned to the soil by ploughing in a crop of cowpea from one acre was—Organic matter, 5,462 lb.; nitrogen, 216 lb.; phosphoric acid, 61 lb.; potash, 123 lb.

EFFICIENT RAT TRAP.

An effective rat trap can be made from a kerosene tin. Cut the top away, and have about 6 inches of water in the bottom. Float chaff on the surface of the water so that the rats do not see it, and on the chaff rest the bait—something rather strong, such as a piece of old meat. Lean a plank against the side of the tin so that the rats can climb up to the top of the tin. One drowned rat does not prevent others from jumping in. It is possible to catch quite a number of rats in this way.

By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PART IV.

THE TAMWORTH.

THE introduction of the Tamworth breed into Australia dates back to near the end of the last century. George T. Chirnside, of Werribee Park, Victoria, was among the earliest importers, and the writer well remembers the time when Tamworths were first introduced to Hawkesbury Agricultural College stud, Richmond, N.S.W., by the presentation by Mr. Chirnside to the College stud of a very fine pair, the progeny of imported parents.

Of these animals, the boar "Cholderton King, 2," was the better, and was the second pig registered in this breed in Australia. That fine boar, "Knowle Indian Prince" (imp.) (1), and N.B. 14587, was the first; it was from the stud of Robert Ibbotson, of Knowle, Warwickshire, England—the most successful breeder, I believe, of Tamworths in England in his day. The Cholderton pigs were from the stud of H. C. Stephens, another well-known British breeder. The first pigs registered in the Australian Herd Book were those from the Hawkesbury College, followed by a team bred at Dunwich Benevolent Asylum, Queensland, and the progeny of a pair presented to Dunwich (Dr. Row was Medical Superintendent at the time) by the Principal (H. W. Potts) of Hawkesbury. The writer had the pleasure of crating and despatching this pair when he was Pig and Bacon Expert at Hawkesbury.

There has been a considerable improvement in type and conformation since those days; although all along it has been essential to discard the short-bodied, thick-set, "Berky" type of Tamworth, since the longer-bodied, more fleshy type is necessary to maintain true Tamworth quality and fleshiness.

In those days the Tamworth pigs bred on the Manning River, N.S.W., were among the best in the Commonwealth; such well-known breeders as the Birds, Martins, Murrays, among many others, being prominent advocates of this old-world breed. There were very few Tamworths in Victoria at that time and practically none at all in the other States except Queensland, where the breed has been in favour for forty years or more.

The breed was accepted for registration in the Berkshire and Yorkshire Society Stud Books in 1914, and, with the change of name to the Australian Stud Pig Breeders' Society, were likewise accepted. They are sponsored by the National Pig Breeders' Association in England and have a world-wide distribution.

Early History of the Tamworth.

The sandy red colour of the Tamworth pig evidences its descent from the old English breed, while its peculiar properties show that in purity of breeding it is second to none. The earliest records of the Tamworths show them to have been a very active race, and of great fecundity. Their fame as producers of lean bacon is historical. Of all the improved breeds the Tamworth existed longer in its natural state, depending chiefly on itself for its food; and it is to this, probably, that is due its persistence of type, safeguarded so jealously by the early breeders and later by Herd Book representation.

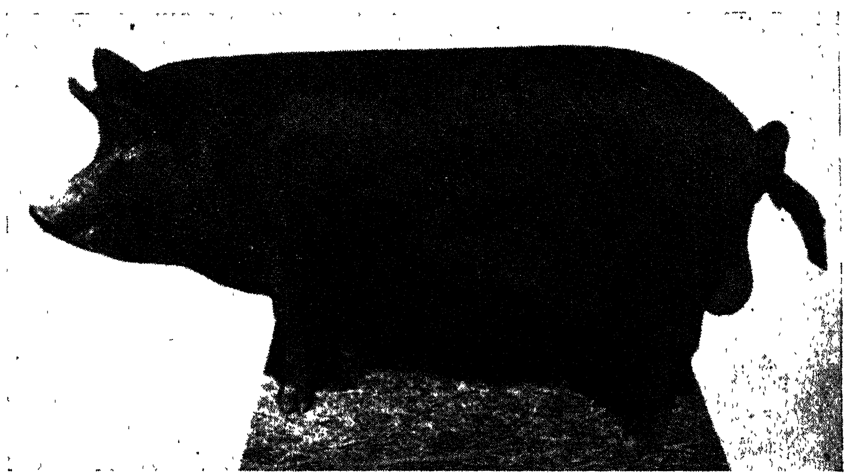


PLATE 242.

Length, depth, and quality are the outstanding features of "Wattledale Top," a championship winner in the Tamworth classes at many Queensland shows. Owned and exhibited by Mr. J. Barkle, "Wattledale," Kingaroy.

A century ago when landowners, farmers, hotel-keepers, cottagers, and others in a position to do so fed their pigs and cured their own bacon—supplying less fortunate neighbours with the unrequired surplus —the Tamworth was undoubtedly one of the most favoured breeds, owing to its ability to produce carcasses with the finest long sides of bacon and big hams.

As time went on bacon factories were established, and pig feeders discovered that fat from their pigs could be sold at an equally remunerative price to lean. It was then that the Neapolitan and other breeds carrying more fat were imported. This action undoubtedly depreciated the percentage of lean meat from the consumer's point of view to such an extent that, like a swing of the pendulum, reaction of vigorous nature has shown itself in recent years, and the demand in England is now for lighter weight bacon with a preponderance of lean meat. This swing over to lean meat and to smaller joints has been experienced also in

Australia, where at one time the very fat pig was highly prized and priced.

American pork and bacon, noted for a larger proportion of fat, and which at one time realised the highest price of all, does not now occupy the same prominent position on British markets.

Improvement in Type.

The present-day Tamworth is certainly a much improved pig to that bred a hundred years ago, this being attributable to the careful attention paid to selection and breeding in later years. It must not be assumed that the improvement has been assisted in any way by the admixture of foreign blood, for this is not so; Tamworths as such have been kept absolutely pure. Undoubtedly, this is one of the many reasons why they hold the position of being one of the finest bacon pigs extant.

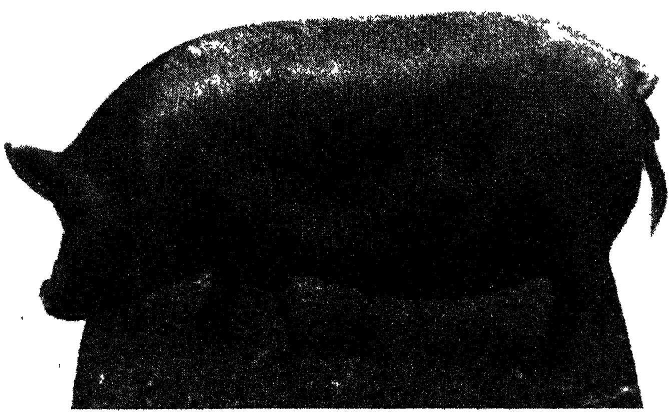


PLATE 243.

To be able to suckle and rear large litters of thrifty pigs is the brood sow's task in life. Such a sow as this has the capacity—she is "Glenburra Molly," from the stud of H. J. Keevers, a noted Richmond River breeder, New South Wales.

There is no doubt, also, that the Tamworth as one of England's oldest pure breeds, has justified its distinction as a breed eminently suitable for crossing where the object is to secure more quality, greater length of side, fine bone and higher percentage of lean meat. As stated, the Tamworth is descended from the old English forest pig without admixture of foreign blood; it therefore preserves the characteristic for leanness which has all along been a cardinal point in its favour. Wherever bacon pig classes (and in many instances pork pig classes also) and carcass competitions have been held, the Tamworth is represented by one cross or another. It has been truly said that there is no more popular cross than the Tamworth-Berkshire for production of bacon and pork in Australia, and in many other parts of the world.

The Tamworth possesses a naturally robust constitution, giving it an advantage in a country like Australia, especially under open air conditions and paddock feeding; for being by nature a grazing animal accustomed to live in the open, he is at his best when kept out of doors. The fact is that the Tamworth is not a good sty pig, his nature rebels

against sty-fed conditions; and he is less resistant to disease than when kept out of doors.

Tamworths Suit the Bacon Curer.

It has recently been computed by a number of leading bacon curers that a long, level-sided pig with fine shoulders, small jowl and back of moderate width, will produce as much as ten per cent. less of fat, and an accordingly increased ratio of lean meat. When it is borne in mind that fat is only worth half as much as lean, it will be appreciated readily how the Tamworth excels as a commercial proposition.

Consistent Prolificacy.

Tamworths are good farm pigs, hardy and prolific breeders, often producing 12 or 14 pigs at a litter (although 8 or 9 is closer to their average). The sows are good sucklers and docile with their young; if they are not, they should be immediately culled and be replaced by better sows.

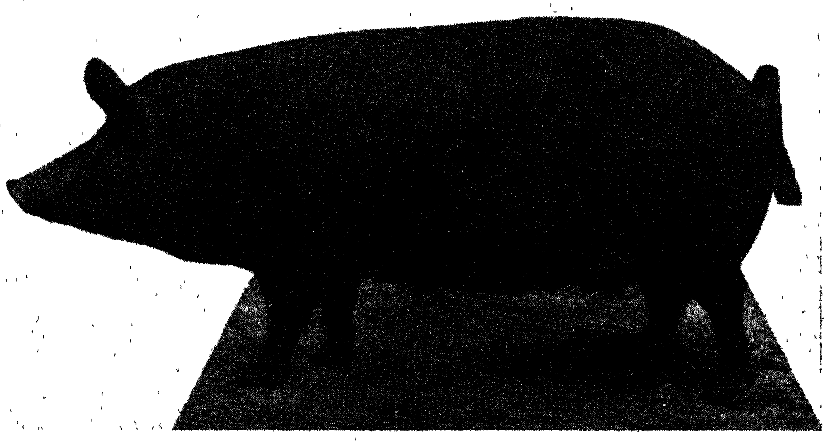


PLATE 244.

"Glenburra Gem," a long-bodied Tamworth sow, with good middle piece, excellent hams, and a light forequarter such as is the objective in selection of breeding stock. She is a product of the Glenburra Stud, and was a prominent prize-winner at Royal National Show, Brisbane.

That Tamworths are long-lived as well as prolific has been proved by an old supporter of the breed in Staffordshire, who until recently had a sow that actually reared 168 pigs from 12 litters—an average of 14. The sow herself realised £17 after weaning her last litter. This is a record in prolificacy not often beaten by sows of the larger breeds.

While it is admitted there are breeds that produce more pigs per litter, the capacity to suckle and rear the progeny is an even more important factor and, generally, the Tamworth can be regarded as a reliable mother. To those who cannot afford to keep pure bred sows, the first cross sow, i.e., first cross between the Tamworth and Berkshire makes an ideal farmer's breeding sow, often superior in capacity to rear large litters to the pure bred.

For Crossing.

For crossing with other breeds the Tamworth can be strongly recommended, this, no doubt, being attributable to the fact that it is the oldest pure breed in England. Its type is, therefore, quite distinct and its prepotency unequalled. Owing to the length and depth of its sides and other characteristics of the baconer, the Tamworth is unexcelled for improving the flesh, fining the shoulders and reducing the jowls of many other breeds. The curer is always seeking to secure greater length of side and less fat in the pigs for his trade. The Tamworth is just the breed to cross with types that are shorter and deeper in body and with more plump compact hams. It is for this reason that the Tamworth has proved so popular as a cross with Berkshires and Middle Whites, which are more compact in body, carry a greater proportion of fat and have well developed hams. Crosses with types like the Large

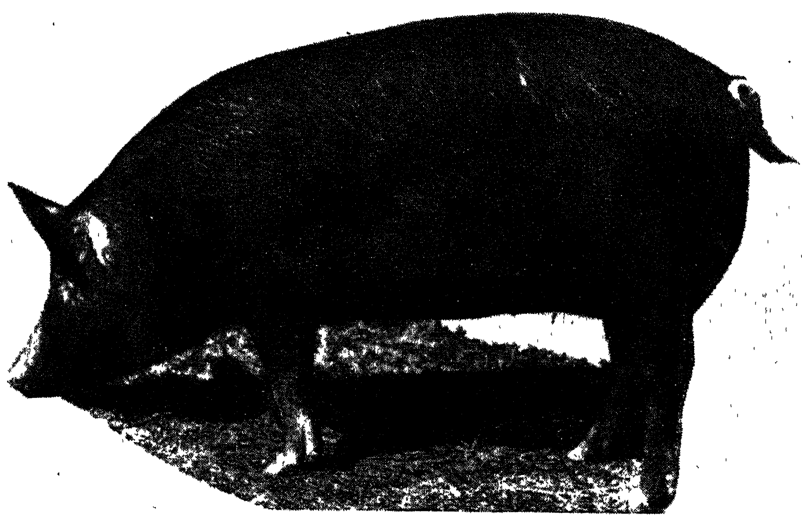


PLATE 245.

"Traveston Viola." Tamworth sow, bred by Mrs. A. Alford, of Traveston, owned and exhibited by G. W. Winch, Zillmere. A really good sow, that has since reared good litters, the photograph being taken when she was quite young after winning first prize at the Royal National Exhibition, Brisbane.

White are not recommended, for reason that both these breeds belong to the large framed class, and if crossed are productive of a type that is too tall and leggy and with insufficient substance, especially for the lighter weight class of pig required for Australian trade; such a cross would be ideal for a bacon pig weighing up to 200 lb. dressed weight—far above the maximum desired in this country. Similarly, it is unwise to expect ideal porkers or baconers when Tamworths are crossed with large type cross-bred sows. The type represented by the Tamworth-Berkshire first cross permits of the progeny being prepared either for the porker or baconer trade, with a decided preference for medium weight pigs in either class.

Colour of the Tamworth.

In a review of the breed in the Jubilee issue (1934-35) of the Pig Breeders' Annual, Mr. J. A. Frost quotes many interesting references to the capacity of the Tamworth to adapt itself to ordinary farm conditions. He states it is the only red-haired breed of pig in Britain, and in that sense is regarded as not only hardy but persistent. The original golden or chestnut colour is said to have been fixed by the foundation sire, a jungle pig imported from India by Sir Francis Lawley, of Middleton Hall, Tamworth, England, about 1800. The Middleton herd played a very prominent part in the breed's early history. After being used on different farms this original jungle pig seems to have had a long and strenuous life and to have stamped his offspring with his own red colour, thereby fixing a distinctive characteristic of a breed which

PLATE 246.

Tamworth Boar of the most approved type. "Berkswell Up-to-date," bred and exhibited by Colonel C. J. H. Wheatley, Berkswell, Warwickshire, England. Illustrated in "Pig Breeders' Annual," published by National Pig Breeders' Association, London.

was to become famous throughout the world. So famous, in fact, that on the dispersal of Robert Ibbotson's herd in 1924, his champion sow "Knowle Favourite" realised the record price of 200 guineas, the buyer being Major J. A. Morrison, a prominent herd master whose pigs have had a wide distribution. The same purchaser paid 150 guineas to secure a boar, "Knowle Newcastle," a noted prize-winner. At Mr. Ibbotson's sale the average for 24 sows and in-pig gilts was £47 3s. 9d.; the general average, including small pigs, being £30 6s. Another celebrated herd was that owned by Mr. Egbert de Hamel, Middleton Hall, Tamworth; Mr. C. L. Coxon secured his earliest stud animals from this herd. Theo. A. Stephens, who edited "Farming" for a number of years and later published the popular "Pigs Journal," was well known to numerous Australians. Mr. H. C. Stephens, of Cholderton Lodge, referred to earlier in this report, was also a very successful breeder.

At present, the largest and by far the most important Tamworth herd in England is owned by Colonel C. J. H. Wheatley, at Berkswell Hall, Coventry, from whose stud the parents of the champion sow at

Brisbane Exhibition, 1934, was imported by Mr. Bartram, of Victoria. Colonel Wheatley has a model piggery, a grand collection of sows and boars, and has been a very prominent prize-winner and importer at all British shows. There is a host of other breeders in England, but, strangely enough, the Tamworth has lost ground in recent years and is to-day not by any means a popular breed there, if one may judge by the very limited number of animals registered each year in the British Isles. In fact, more Tamworths are now registered in Australia every year than in Great Britain. This very fact should give breeders of Tamworths in Australia an excellent opportunity, for, with a shortage in England and a world-wide demand, it behoves Australian breeders to advertise extensively and bring before the world the wonderful quality and improved type of Tamworth pigs as bred here. It can justly be claimed that we now have in Australia, and in Queensland in particular, Tamworths equal in quality to the imported stock; thanks to imported parents plus care in breeding, feeding, and handling.

PLATE 247.

Group of prize-winning Tamworth sows, Royal Easter Show, Sydney. Owned and exhibited by Mr. F. S. Ebbern, Kelso, New South Wales.

The Tamworth breed owes much of its success in this country to the New South Wales Department of Agriculture, to the Hawkesbury Agricultural College, and, in more recent years, to the imported animals selected in England by Mr. Andy F. Gray, Senior Piggery Instructor in the New South Wales Agricultural Department, whose constant advocacy of the Tamworth-Berkshire cross has borne good fruit, and has assisted considerably in maintaining for the Tamworth its place among breeds of pigs in Australia.

Queensland breeders of Tamworths represented at the 1934 Royal National Exhibition, include Messrs. Jas. Barkle of the Wattledale Stud, Kingaroy; Bowman & Sons, Kin Kin; P. V. Campbell, Lawn Hill, Lamington; W. S. Hendry, Ascot Vale, Clifton; H. B. Kerner, Warwick Road, Ipswich; E. L. Melville, Caboonbah; M. Moffatt, Billinudgel, New South Wales; H. H. Sellars, Tabooba; Wide Bay Stud Piggery, Gympie; and G. W. Winch, Church Road, Zillmere. Many of the animals trace back to the Traveston Herd owned by Mrs. A. Alford. Mr. Lloyd Skerman, of Waverley, Kainkillenbun, is another successful junior breeder and exhibitor.

Following is the standard of Excellence adopted by the Australian Stud Pig Breeders' Society:—

STANDARD OF EXCELLENCE FOR TAMWORTHS.

	Points.
Head and Ears.—Head fairly long; snout moderately long and quite straight; face slightly dished, wide between ears; ears rather large, with fine fringe carried rigid and inclined slightly forward	15
Neck and Shoulders.—Fairly long and muscular, especially in boar; chest wide and deep; shoulders fine, slanting, and well set	10
Back and Sides.—Back long and straight, with loin strong and broad; sides deep; ribs well sprung, and extending well up to flank; belly deep, with straight underline; and in sows, twelve good, evenly placed teats ..	20
Hams.—Broad, full, well let down to hocks; tail well set up and well tasselled	20
Legs and Feet.—Legs strong and shapely, with plenty of bone, set well outside the body; pasterns strong and sloping; feet strong and of fair size	15
Colour, Skin, and Hair.—Golden red hair on a flesh-coloured skin, free from black; skin fine and free from wrinkles; hair abundant, long, straight, and fine	10
Character.—A combination of all the points showing distinctive breeding, type, and quality	10
	100

PLATE 248.

RESERVE CHAMPION LARGE WHITE SOW.—"Gatton Vera." Exhibited by Gatton College.

Cucumber Growing

Supplied by the Fruit Branch.

THE warmth of the climate makes this crop a very suitable one for this State. In the coastal and northern districts several crops can be grown during the season.

Planting is usually done in the southern, coastal, and inland districts from September to January, and on the tablelands from October to January; in the northern districts, on the coastal areas from July to January, and on the tableland and inland areas from August to January.

The Agricultural Chemist, in his pamphlet on "Complete Fertilizers," states: Cucumbers may be grown on almost any soil so long as it is fairly light and loamy and plenty of manure is added. The pits or hills should be prepared by mixing a large amount of well-rotted stable manure, sheep or fowl dung, ashes, and bonedust with the soil. Apply in addition the following artificial fertilizer:—

1½ cwt. sulphate of ammonia or nitrate of soda;

3 to 4 cwt. Nauru phosphate—superphosphate mixture;

1 to 1½ cwt. sulphate of potash;

or 6 to 8 cwt. of a 5-12-5 mixed fertilizer per acre, or 2 to 3 oz. of the same mixture per square yard.

The terms "pits" or "hills" are used to represent groups of four or five plants. At one time the seed was always sown on hills raised above the ground level, but unless the ground is badly drained this practice need not be followed.

Four or five plants are sufficient to a "hill," and the seeds should be placed 3 or 4 inches apart and about 1 inch below the surface. The "hills" should be about 4 feet apart each way, and the whole surface left loosely cultivated.

Should the plants send out their runners to a distance of 2 or 3 feet without setting cucumbers, fruiting may often be induced by pinching out the tips of the runners.

Cucumbers should be harvested when nearly full grown, before the seeds harden and the skin begins to turn yellow.

The time from planting to harvesting is usually about three months, and 1 lb. of seed set out as directed will plant an acre.

The varieties recommended are: For market purposes, Imperial White Spine; for pickling, Early Green Cluster.

If you like this issue of the Journal, kindly bring it under the notice of a neighbour who is not already a subscriber. To the man on the land it is free. All that he is asked to do is to complete the Order Form on another page and send it to the Under Secretary, Department of Agriculture and Stock, together with a shilling postal note, or its value in postage stamps, to cover postage for twelve months.

Standardised Judging of Fruit.

By JAS. H. GREGORY, Instructor in Fruit Packing.

THE aim of all fruit exhibitions should be the improvement and advancement of the fruit industry. The achievement of this can be advanced by close attention to the production of better-quality fruit and the use of better marketing methods. The exhibition of fruit at shows is of appreciable assistance in permitting comparisons to be made of different growing methods, and their ultimate result in quality and colour. The progress of various packing methods may also be examined per medium of the show bench.

To obtain the most helpful results from the fruit displayed, only one system of comparison for judging can be used—namely, the points system of making awards. The use of this system places the judge in the position of helping the exhibitor, the particular advantages of any exhibit being definitely compared. Judges using a comparison not embracing a definite points system lose this advantage to the exhibitor, often resulting in dissatisfaction. The allotment of points can be left to the judge, a variation of the number allowed to each section being made at the discretion of the judge according to the particular section of the exhibition.

The following tables of points are suggested as a good basis to work on. This table may be varied to suit the various classes of exhibits, a basis of 100 points being allotted to each exhibit. As an example, where fruit is displayed in a section for fruit only, the whole 100 points would be allotted for the fruit; but where it is a case or tray section the 100 points would be split into two sections, 60 points for the fruit and 40 points for packing, &c., totalling 100 points. An examination of tables given for "Fruit Packing Classes" and for "Specified Classes" will serve as a basis of comparison:—

POINTS GIVEN WHEN JUDGING FRUIT PACKING CLASSES.

	Points.
Fruit—	
Type	15
Colour	10
Freedom from Imperfections	15
Quality	10
Maturity	10
Packing—	
Alignment	10
Height	10
Sizing	10
Compactness	10
Total	100

POINTS GIVEN WHEN JUDGING SPECIFIED CLASSES, SUCH AS FOR EXPORT, COOKING, OR DESSERT:

	Points.
Fruit—	
Commercial Value	5
Suitability	5
Type	5
Colour	10
Freedom from Disease, Imperfections, &c.	15
Quality	10
Maturity	10
Packing—	
Height	10
Alignment	5
Sizing	5
Compactness	10
Wrapping	5
Get-up	5
Total	100

These tables may be adapted to all fruit. An explanation of the various headings used should be of assistance:—

Type: Shape; natural size for the variety; with citrus absence of pips according to variety, size of navel if any, texture of skin.

Colour: Colour of fruit at maturity.

Quality: With citrus, thickness of rind, amount of rag inside, juice content, coarseness of cells; other fruits, texture of flesh, juice content, colour of flesh, and flavour.

Maturity: Size and colour of pips; colour of skin and flesh; flavour; acid content in citrus.

Freedom from Imperfections: Freedom from skin blemishes, spray damage, and disease or insect infestation.

Commercial Value: Suitability of the variety commercially for the particular class of entry; i.e., export class, variety Granny Smith apples would have a higher commercial export value than Pomme de Neige or Farmuese.

Suitability: Export classes, this would embrace size, variety, and ripeness.

LIME WATER FOR CALVES.

Besides being a necessary mineral constituent for all classes of animals, lime acts also in correcting acidity in the stomach. It also renders the curd portion of milk more readily digestible, particularly by young calves.

Lime-water of the requisite strength is easily made on the farm. There need be no fear of making it too strong, as water will only dissolve a certain limited amount of lime—½ grain to the ounce, or 10 grains to the pint. Add a bucketful (say, 20 lb.) of lime to about 10 gallons of water in a wooden barrel, stir well, and allow to settle. The clear liquid resulting can be used, and water added and stirred daily until all the soluble portion of the lime has dissolved—the lack of alkaline flavour will indicate when this point has been reached, and a fresh supply of lime should be added to the barrel.

Marketing Notes.

By JAS. H. GREGORY, Instructor in Fruit Packing.

Tomatoes.

INSPECTIONS in the Brisbane markets reveal that growers have not profited by marketing results of past seasons in respect of green tomatoes. Many consignments of tomatoes have cases containing from green to ripe fruit; from the marketing point of view this is unsatisfactory to buyers. Growers would find that an effort at colour grading, in conjunction with good packing, would be well repaid. Close attention should also be paid to interstate consignments, care being taken to eliminate all immature fruit. Immature fruit early in the season has a depressing effect upon the market from which it takes a lot to make it recover.

Papaws.

During the winter papaws have been sent successfully to the Southern markets in a more advanced stage of ripeness (i.e., firm coloured) than in previous years. While this practice is correct for the cooler months, care must be taken now that the hot weather is approaching to select fruit in a less advanced state of maturity. This applies particularly to Melbourne consignments, which have a much further and hotter journey than Sydney consignments.

Citrus.

The Queensland citrus season is now drawing to a close, but marketing conditions remain the same. Regularity of consignments is the only method of obtaining the best from the present unsatisfactory state of the market. Small fruit should, as far as possible, be kept off the market. Growers, by rotating their picking and carefully selecting the largest fruit at each picking, will considerably increase their yield and quality, thereby enhancing the tone of the market and getting better prices.

Stone Fruits.

Now that the stone-fruit season is upon us growers should become acquainted with the marketing regulations. Grade standards for the stone fruits must be carefully adhered to. Close attention to packing-shed cleanliness should be observed if the dreaded brown rot is to be kept within bounds. All reject fruit should be carefully destroyed and not left in cases or picking boxes in the shed. This will also help in keeping fruit-fly within bounds. Growers will find that close attention to sizing all fruits will be amply repaid.

CARE OF THE SEPARATOR.

The operation of the separator and the care devoted to its cleansing have a material effect on the quality of cream produced. On no account should the separator be left overnight without being dismantled, and all parts thoroughly cleansed and scalded. After separating, all utensils and separator parts with which milk has come in contact, including the vats, buckets, and strainer, should be washed with slightly warmed water and then submerged in boiling water and placed on racks to drain. The practice of wiping over the utensils with a cloth after scalding only serves to undo the work of sterilisation and to reinfect with bacterial organisms.

Milk should not be left lying about on the floor or under the separator block, and the surroundings should be kept sweet and clean, and the drains free to carry away the floor washings.

By H. W. BALL, Assistant Experimentalist.

THE rainfall for the months of August and September was generally under average throughout Queensland, so that seasonal crops were affected and natural feed reserves were becoming depleted by the time the welcome change occurred during the second week of October. The recent excellent rains throughout the farming areas will expedite the sowing of cotton, maize, tobacco, peanuts, and summer fodder crops.

Wheat.

Harvesting is now in full swing, and, providing no damaging storms or heavy rains are experienced during this important period, an average crop of good quality wheat should be garnered. Prospects appear particularly good in the Pittsworth district, where farmers benefited by conserving much of the heavy rain of the previous summer. It is the late-sown areas that will give the lightest return, indicating that the importance of thorough cultivation during a reasonably long fallow period cannot be too strongly emphasised. Excellent crops are also reported from the Dalby district, notably on the Jimbour plain.

Considerable expansion of the wheat and dairying industries is taking place in the Dalby area on lands previously devoted to sheep-raising.

In the Clifton, Allora, and Warwick districts the returns will be under average, partly because of lands being withheld from cultivation owing to the wild oat pest. These areas have been cropped to wheat for over fifty years, and the need for a long fallow period, to assist in reducing weed pests, is now apparent. Very little wheat will be harvested in the Maranoa this year, owing to the dry conditions experienced, and also to an attack by grasshoppers shortly after the plants appeared above ground. Isolated farms will yield good crops, notably in the Wallumbilla area, where the sandy loam soils favour the retention of moisture, so important in a comparatively dry area. Wheat is a precarious crop, and the grower knows from experience that he is never sure of his return until the grain is in the bag, so that a yield forecast can only be approximate.

PLATE 249.—A FINE PADDOCK OF PUSA WHEAT NEAR YANGAN.
" . . . a-keepin' of my feet,
While I cater for the nation with my wheat, wheat, wheat."

Tobacco.

Considerable attention will again be devoted to tobacco experimental work, the season's programme including variety, rotational, fertilizer, and green manurial trials, together with seed propagation plots in selected pure-seed areas. The planting of seed beds will now be proceeding, and growers are strongly advised to spray in accordance with departmental recommendations. Blue mould and leaf miner have been reported from seed beds sown during August and early October, where such spraying was not carried out. Such beds are a menace to those

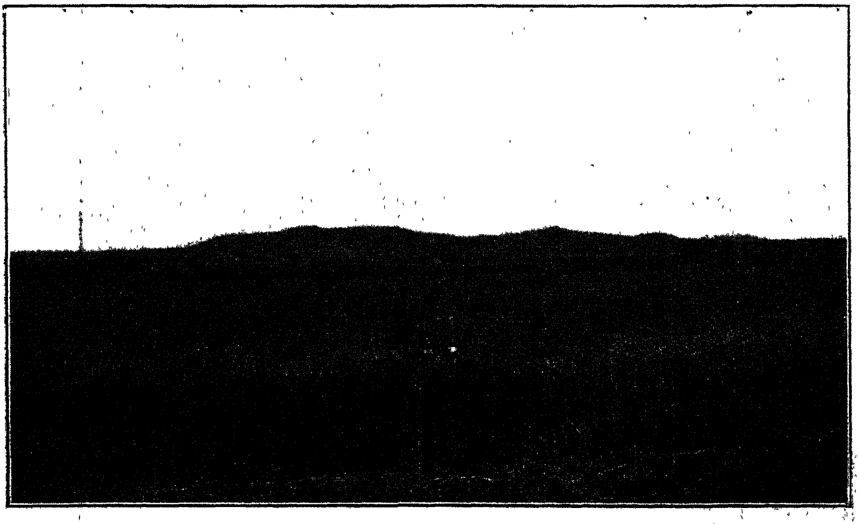


PLATE 250.—ANOTHER FINE STAND OF PUSA NEAR WESTBROOK.
"Of the world's great work he has done his share who has garnered a crop of wheat."

established later on, and point to the need for a definite break of at least three months from the time the residue of one crop is destroyed, until the seed of the succeeding crop is sown.

PLATE 251.—A FIELD OF CLARENDON WHEAT NEAR TANNYMOREL.
"Sowin' things an' growin' things, an' watchin' of 'em grow."

Sugar.

Increasing temperatures have accelerated the growth of cane in the far North, and welcome falls of rain of upwards of 2 inches were recorded in the Mackay and Bundaberg districts in the latter half of the

PLATE 252.—ANOTHER GOOD CROP OF CLARENDON NEAR WESTBROOK.
". . . From God's earth His gift of wheat."

month. This has considerably improved the outlook, although subsequent drying winds have nullified the benefits to some extent in the Bundaberg district.

PLATE 253.—ANOTHER FINE STAND OF CLARENDON ON CANNING DOWNS.

"Oh, I am the grass that has conquered man,
I am the King that is Bread!
Your armies and fleets are but fragile things
That await a nod of my head."

Crushing has been completed at Babinda and Mossman, where tonnages greatly below those of last year were crushed. Crops continue to cut above estimates in the Central and Southern districts, but owing

PLATE 254.—A FAMILIAR SIGHT ON THE DARLING DOWNS DURING THE WHEAT HARVEST.

"Then I come up bright an' grinnin' with the knowledge that I'm winnin'
With the rhythm of my harvester an' wheat, wheat, wheat."

to the lower tonnages in the North it is anticipated that the amount of sugar in No. 1 Pool will be somewhat less than was the case last year.

Flax.

Assistance has been granted through the Rural Assistance Board to a Flax and Linseed Company operating in Queensland. A large home market awaits the linseed grower, but hitherto there has been no demand for the flax fibre owing to the lack of manufacturing interest. Experience with this crop in Queensland is too limited to state definitely its possibilities, but the wise policy of encouraging the development of any promising sideline is being pursued.

General.

Large areas are being sown to maize, sorghums, sudan grass, and millets for fodder purposes. The preparation of land was held up considerably by the previous dry spell, but farmers are now losing no time in taking advantage of the altered conditions. Early potatoes have brought very remunerative prices, up to £20 per ton having been received. Reports indicate that the canary seed crop will be below average, owing to considerable areas being utilised for fodder purposes.

PLATE 255.—A CABBAGE FROM ST. LUCIA.

At St. Lucia Farm School vegetable gardening is an important part of the curriculum. This specimen was one of a large number of heavyweights. It tipped the beam at 18 lb.

Brisbane Show Champions, 1934.

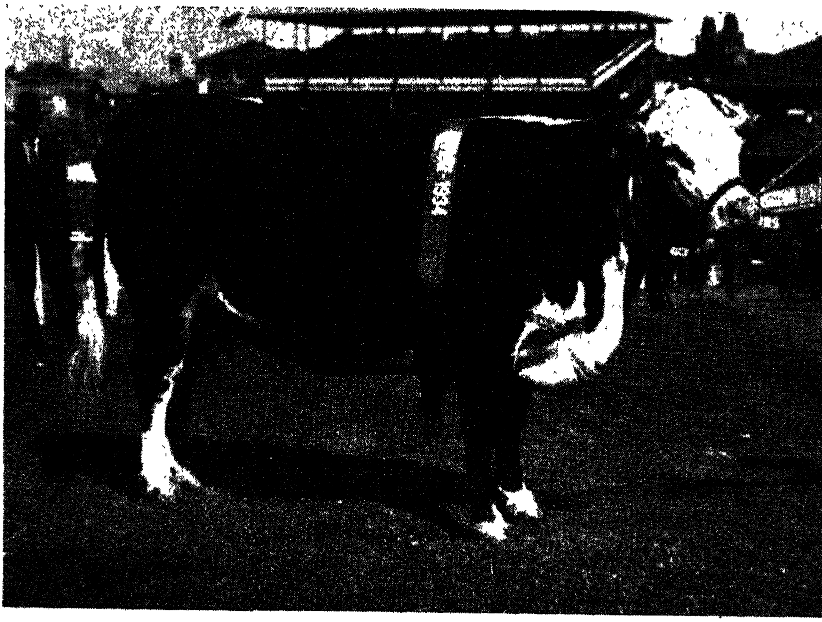


PLATE 256.
Champion Polled Hereford Cow, "Lovely II." (S. A. Plant).

PLATE 257.
Champion Friesian Bull, "Tent Hill Starlight Actuary" (W. H. Grams).

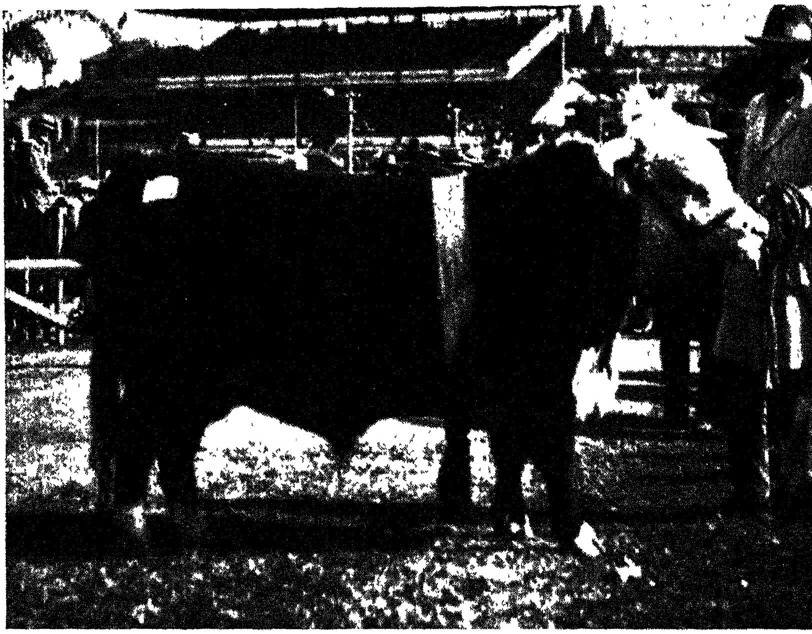


PLATE 258.
Champion Hereford Bull, "Mc Mel Chieftain" (C. S. Rowntree).

PLATE 259.
Champion Guernsey Cow, "Carramana Dolly" (A. E. Gillespie).

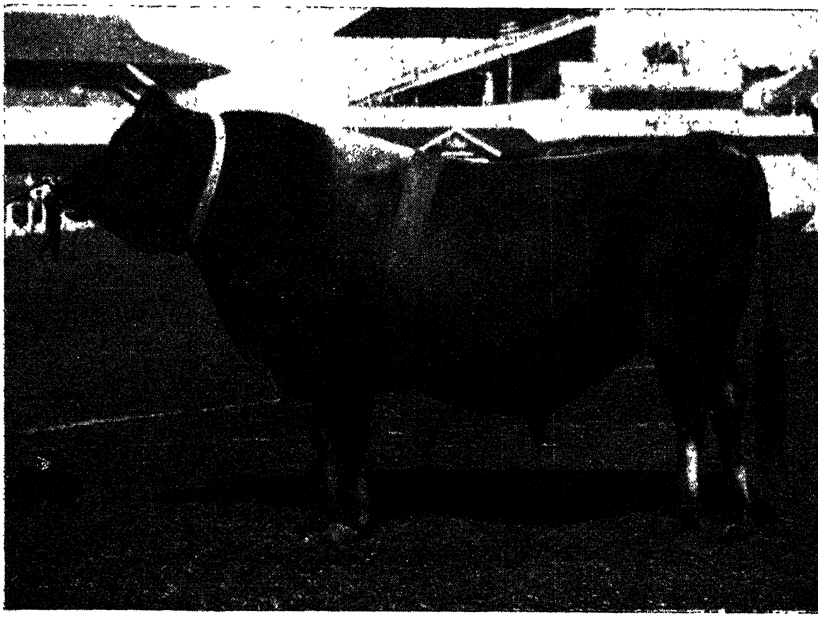


PLATE 260.
Champion Jersey Bull, "Trinity Darby" (W. W. Mallett).

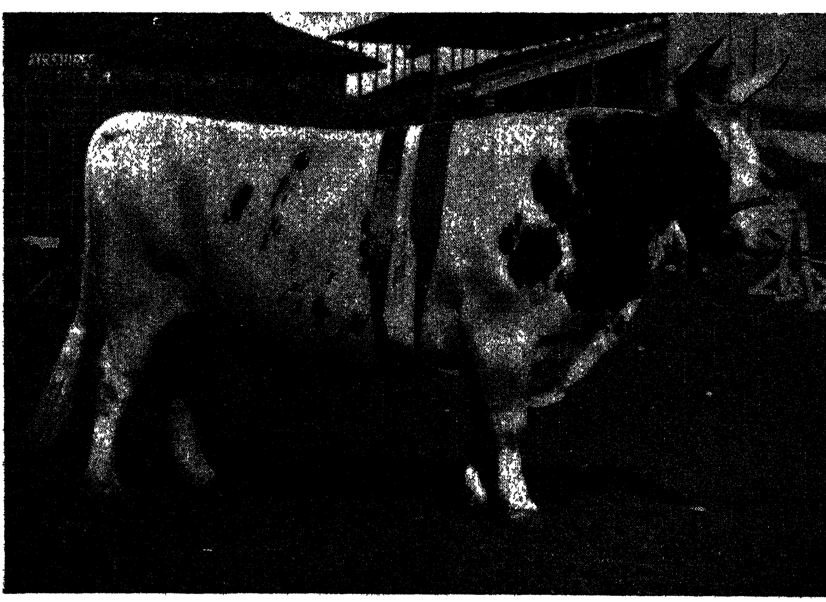


PLATE 261.
Champion Ayrshire Bull, "Longlands Bosca" (T. E. Holmes).

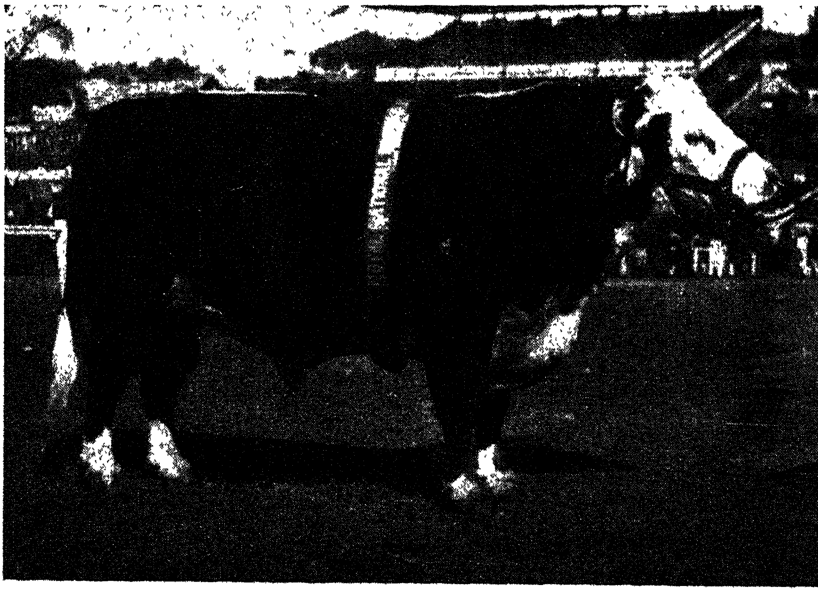


PLATE 262.
Champion Polled Hereford Bull, "Trevanna King" (S. A. Plant).

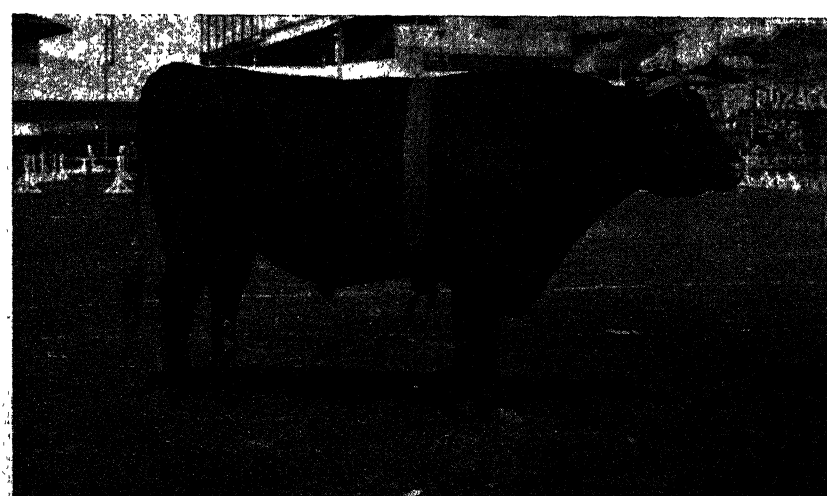


PLATE 263.
Champion A.I.S. Bull, "Patrol of Cosy Camp" (Paul Moore).

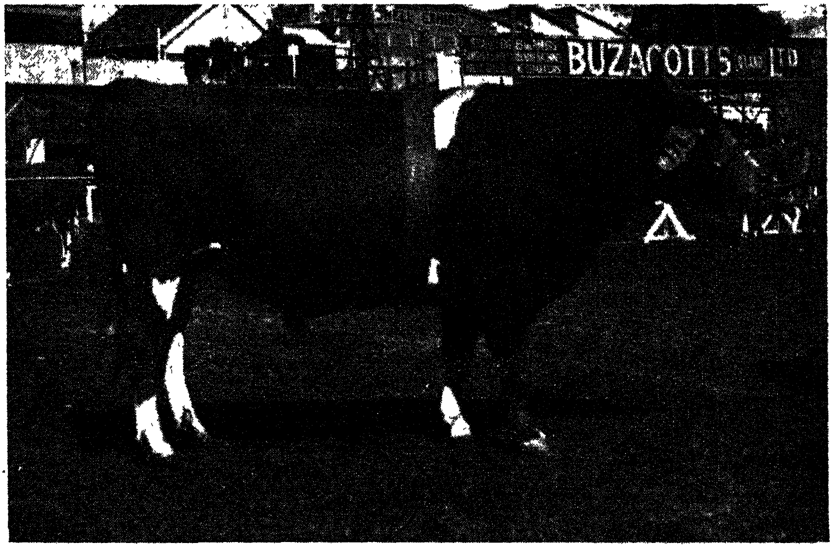


PLATE 264.
Champion Guernsey Bull at the Brisbane Show, "Spurfield Rocket," owned by A. E. Gillespie, Tanto, Springbrook.

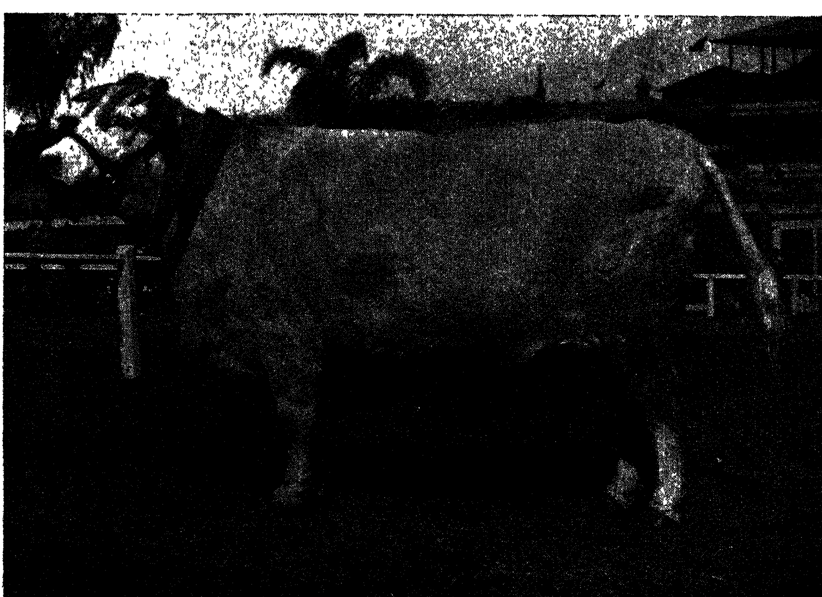


PLATE 265.
Champion Beef Shorthorn Cow at the Brisbane Show, "Netherby Snow Queen," owned by J. T. Scrymgeour, of Netherby, near Warwick.

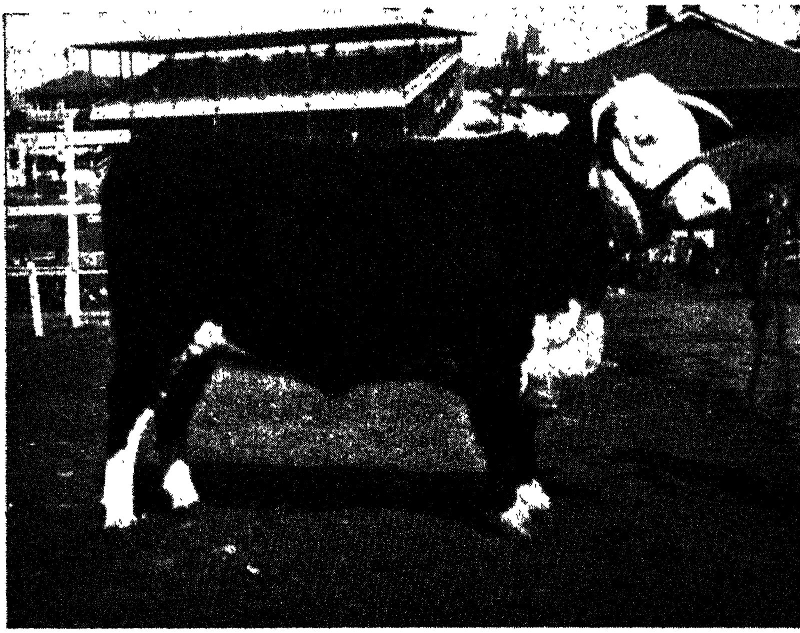


PLATE 266.
Champion Hereford Heifer at the Brisbane Show, "Ennisview Cherry Ripe IV." (E. R. Reynolds).

PLATE 267.
Champion A.A. Cow at the Brisbane Show, "Bald Blair Twinkle IV." (F. J. White and Son).

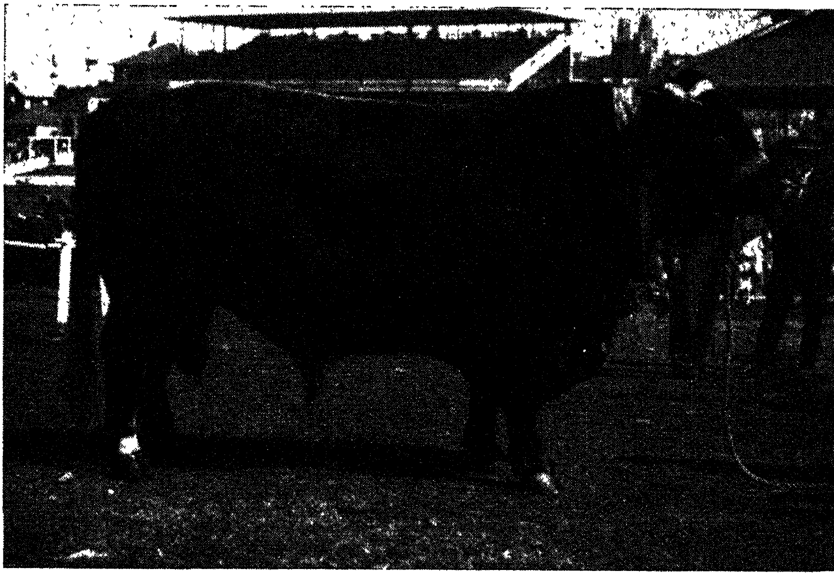


Plate 268.
Champion Shorthorn Bull, "Netherby Royal Challenge" (J. T. Scrymgeour).

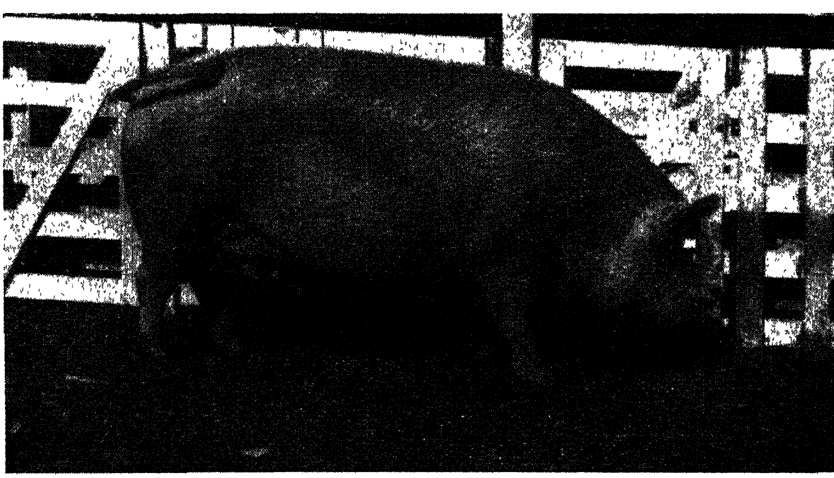


Plate 269.
Champion Large White Sow.—"Pine Terrace Pear" (imp.). Exhibited by J. A. Heading, Murgon.

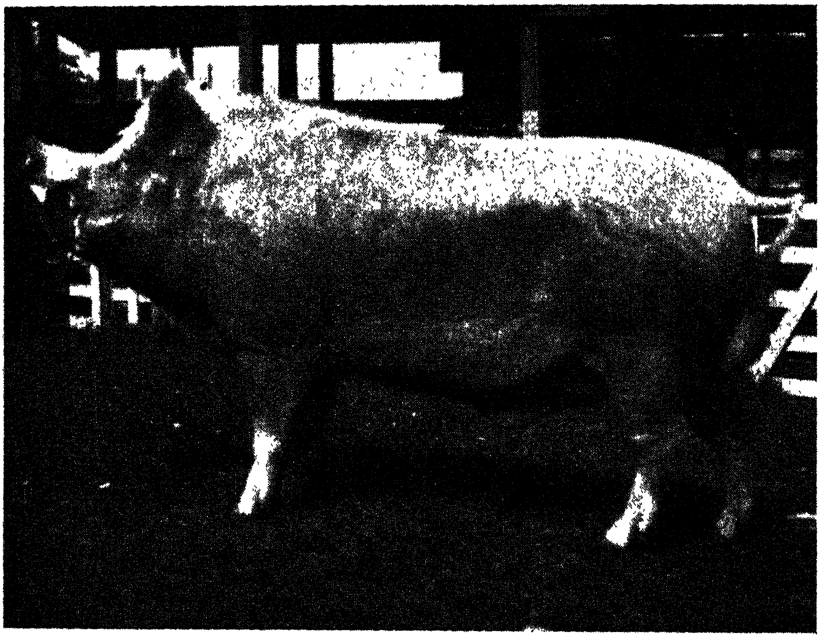


PLATE 270.

CHAMPION LARGE WHITE BOAR.—"Norfolk King David 5th." Exhibited by the Queensland Agricultural College and High School.

PLATE 271.

CHAMPION MIDDLE WHITE SOW.—"Norfolk Poppy 3rd." Exhibited by J. J. Slack, Dinmore.

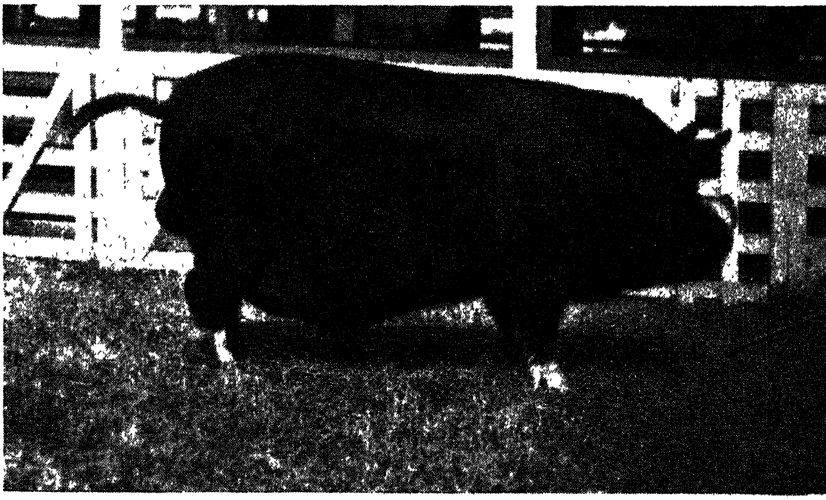


PLATE 272.

"Grafton Trump," who carries English blood, has proved himself an excellent stock getter and prize winner; among his winnings is the boar and progeny prize at the Brisbane Exhibition, 1934. Exhibited by Messrs. Mat. Porter and Sons, Wondai.

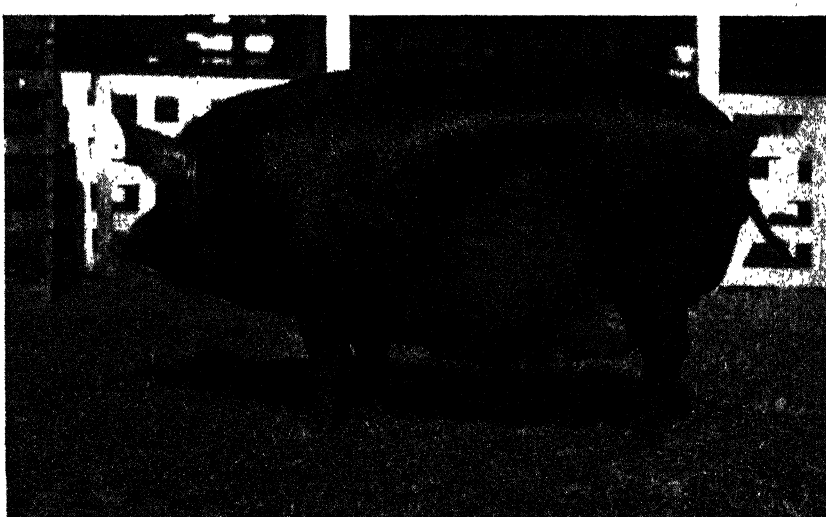


PLATE 273.

CHAMPION TAMWORTH SOW.—"Warringal Precocious," imp. in dam. Exhibited by J. Barkle and Son, Kingaroy, at the Brisbane Show.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Red Poll Cattle Society, and the Friesian Cattle Club, production charts for which were compiled for the month of August, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Gem IV. of Oakvilla	H. Marquardt, Wondai	11,293·62	456·677	Victory of Greyleigh
Pansy 4th of Oakvilla	H. Marquardt, Wondai	11,716 91	444·99	Victorious of Oakvilla
Princess II. of Headlands	J. A. Heading, Cloyna	13,215·69	424 681	Major of Rosemount
Ashdale Red Duchess	A. Frank, Boonah	9,363·9	423·176	First Warrior of the Cedars
Molly of Mount View	V. Dunstan, Wolvi	9,551·65	382·498	Charming Lad of Hillview
Darling of Salt Bush Park	R. Ray, Yargullen	9,684·0	359·727	Hero of Strathdu
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Duchess of Kalinga	J. A Heading, Cloyna	10,480 71	418·915	Duchess Jellicoe of Fairfield
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Green Ridge Primrose 7th	E. W. Lawley, Maleny	8,601·7	338·435	Perfection of Ailey
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Morden Sparkle (365 days)	R. Mears, Toogoolawah	16,239 8	659·276	George of Nestles
Springleigh Tulip (258 days)	Moller Brothers, Boonah	8,207·05	329·643	Red Knight of the Cedars
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Blacklands Red Plum 6th	M. C. and A. M. Sullivan, Pittsworth	9,928·47	324·47	Hugo of Blacklands
Kilbirnie Bella 17th	Macfarlane Bros., Radford	7,476·15	309 316	Kilbirnie Guardsman
Jess IV. of Blacklands (258 days)	A. M. Johnson, Gracemere	7,677·2	309 107	Hugo of Blacklands
Beaudetta 3rd of Springleigh	Moller Bros., Boonah	8,217·6	300·220	Red Knight of the Cedars
College Ettie 3rd	Queensland Agricultural High School and College, Gatton	6,930 85	299 446	Fussy's Kitchener of Hillview

SENIOR 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.—*continued.*				
Rosalind II. of Headlands	J. A. Heading, Cloyna	6,959·59	278·806	Headlands Red Plum
Lucy VII. of Blacklands (257 days)	A. M. Johnson, Gracemere	6,141·45	270·206	Orama of Blacklands
Blacklands Fancy 5th	M. C. and A. M. Sullivan, Pittsworth	7,768·55	268·792	Major of Blacklands
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Claredale Dainty	J. E. Smith, Brookstead	8,610·7	358·954	Wilga Vale Masterpiece
College Queenie 2nd	Queensland Agricultural High School and College, Gatton	7,779·2	322·707	Duplex of Greyleigh
Heather of Glengarry	Geo. Waugh, Peeramon	7,227·3	312·605	Jean 7th Prince of Blacklands
Highfield Pink II.	J. A. Heading, Cloyna	8,502·94	306·639	Banker II. of Greenslopes
College Beryl	Queensland Agricultural High School and College, Gatton	6,820·03	286·127	Fussy's Kitchener of Hillview
Mabreen Rosebud	V. Dunstan, Wolvi	7,063·3	285·781	Numbawarra Headlight
Brundah Elfin II.	Mrs. K. Henry, Greenmount	7,417·71	277·959	Enchanter of Carawarra
Rosemount Melba 12th	P. D. Feichtner, junr., Hirstvale Road	7,174·36	272·553	Bright Star of Cosey Camp
Highfield Princess II.	J. A. Heading, Murgon	6,922·82	269·492	Gloaming of Hill Top
Kingsdale Dulcie 14th	A. A. King, Mooloolah	6,214·15	264·85	Express of Burradale
Sadie of Glengarry	Geo. Waugh, Peeramon	6,125·05	258·223	Jean 7th Prince of Blacklands
Lavender 18th of Quarnlea	Lehfeldt Bros., Kalapa	6,478·37	247·571	Colonel of Quarnlea
College Rachel	Queensland Agricultural High School and College, Gatton	6,434·36	240·042	Duplex of Greyleigh
Brundah Fidget III.	Mrs. K. Henry, Greenmount	6,465·28	232·046	Enchanter of Carawarra

JERSEY.

MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Oxford Favourite Queen	E. Burton and Sons, Wanora	5,785·92	377·648	Oxford Renown
Glengarry Tirania 4th	J. and R. Williams, Crawford	7,428·7	392·729	Glengarry Benedictines Heir
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Langside Quip	G. W. Young, Inverlaw	6,577·75	396·701	Masterpiece Yeribee of Brucevale
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Lavender of Calton (365 days)	E. Burton and Sons, Wanora	15,248·97	773·424	Prince Clair of Calton
Golden Lassie of Inverlaw	R. J. Crawford, Inverlaw	6,455·35	351·616	Langside Claribella Masterpiece

Production Recording—*continued*.

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	JERSEY—*continued*.			
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Langside June Twylish	G. W. Young, Inverlaw	6,497·0	322·53	Masterpiece Yeribee of Brucevale
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Wyreene Pet	J. B. Keys, Gowrie Little Plains	5,343 6	261·281	Goldfinder's Prospector of Morago
College Silva	Queensland Agricultural High School and College, Gatton	5,619·21	332·295	College Silverside
Langside Prim	G. W. Young, Inverlaw	6,158·85	317·154	Masterpiece Yeribee of Brucevale
Glenview Mabel	F. P. Fowler and Sons, Coalstoun Lakes	4,550·85	271·897	Trinity Officer
College Pearl	Queensland Agricultural High School and College, Gatton	4,929·71	270·552	Burnside Defender
College Pixie	Queensland Agricultural High School and College, Gatton	5,043·6	265·563	Burnside Renown
Xenias Charm of Inverlaw	R. J. Crawford, Inverlaw	4,863·6	237·977	Montrose Gypsy of Glen Iris
	RED POLL.			
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Marshlands Prudent Farmer 2nd	C. E. McConnell, Marshlands	7,357·85	279·666	Silver Spring Bulwark
	FRIESIAN.			
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Oaklands Beauty Rock 5th	W. Richters, Tingoora	8,595·45	328·928	Pied Rock
Oaklands Fanny Rock 2nd	W. Richters, Tingoora	7,921·34	305·254	Pied Rock
Oaklands Winara Rock 3rd	W. Richters, Tingoora	7,906·63	287·559	Pied Rock
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Oaklands Holly Pearl 8th	W. Richters, Tingoora	7,409·03	273·414	Pied Rock

Photo.: "Courier-Mail."]

PLATE 274.—THE VALLEY OF THE TWEED.
From Queensland's Southern Border.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Friesian Cattle Club, and the Red Poll Cattle Society, production charts for which were compiled for the month of September, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Penrhos Pansy	A. Sandiland, junr., Wildash	13,066·5	569·177	Strathdhu Admiration II.
Elsie of Blacklands	H. D. Giles, Biggenden	10,761·9	496·870	Jeans Monarch of Blacklands
Dinky of Bellwood	S. J. Currant, Gunalda	8,513·5	398·582	Triumph of Oakvale
Amy of Glenleigh	C. O'Sullivan, Greenmount	9,710·7	396·040	Brightlight of Darbalara
Necklace of Hilltop	J. A. Heading, Murgon	9,340·09	365·807	Major of Rosemount
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Rocklyn Baroness	T. Strain, Wondai	10,614·31	374·295	King of Sunnyside
Glenroy Pearl	W. F. Kajewski, Glencoe	8,681·23	358·704	Brilliant 2nd of Oakvale
Merridale Lady Gentle	H. D. Giles, Biggenden	8,017·7	348·736	Reflection of Blacklands
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Rocklyn Heather	T. Strain, Wondai	8,359·56	368·742	King of Sunnyside
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Burradale Daisy 15th	W. F. Kajewski, Glencoe	8,046·74	356·339	Lovely's Earl of Glenthorn
Dnalwon Cherry 2nd	B. J. Nothling, Witta, Maleny	8,379·2	336·628	Limelight of Raleigh
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Navillus Amy 2nd	C. O'Sullivan, Greenmount	9,326·75	401·97	Midget's Sheik of Westbrook
Navillus Princess	C. O'Sullivan, Greenmount	9,584·01	374·285	Triumph of Comberton Grange
Merridale Laura	H. D. Giles, Biggenden	5,905·9	271·560	Reflection of Blacklands

	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Glenroy Emerald	W. F. Kajewski, Glencoe	9,111 78	351·386	Glenroy Kitchener
Damsel 10th of Glenthorn	W. F. Kajewski, Glencoe	7,669 98	325·377	Shamrock's Triumph of Burradale
Honey 8th of Sunnyside	P. Moore, Wooroolin West	7,566 31	298·849	Bruce of Avonel
Mirth 3rd of Blacklands	A. Pickels, Wondai	6,513·15	290·405	Orama of Blacklands
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
College Rascal 2nd	Queensland Agricultural High School and College, Gatton	8,004 55	337 043	Fussy's Kitchener of Hillview
College Stately 2nd	Queensland Agricultural High School and College, Gatton	6,194 42	308 546	Duplex of Greyleigh
Glenroy Chrystal	W. F. Kajewski, Glencoe	7,055·89	283 27	Digger of Burradale
Rosenthal Hope 15th	R. V. Littleton, Crow's Nest	5,035·56	208·518	Rosenthal Handsome Boy
Rosenthal Lilac 3rd	S. Mitchell, Warwick	5,918 25	254·371	Handsome Boy
	JERSEY.			
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Billabong Daisy	J. Mollinhauer, Moffattdale	8,129 46	415 008	Premier of Calton
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Linda of Calton	F. J. Cox, Imbil	6,495·15	341·473	Prince Clair of Calton
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Trecarne Jean	R. A. Slaughter, Clifton	7,683 67	391 671	Mascot of Brassaldale
Langside Hurette Hope	G. W. Young, Inverlaw	5,669 2	323·860	Masterpiece Yoribee of Bruecvale
Wyreene Rose Marie	J. B. Keys, Gowrie Little Plains	5,780·04	284 626	Lyndhurst Victor
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
G. N. Loda 2nd	Cox Bros., Maleny	4,794·8	299·719	Retford Royal Atavist
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Camelon Princess	H. Neil, Brassall	5,169 17	323 695	Carnation Prince's King
College Starbright 3rd	Queensland Agricultural High School and College, Gatton	5,541·83	309·220	Burnside Defender
G. N. Hecla	Cox Bros., Maleny	5,136·15	277·475	Retford Royal Atavist
Twylish Madeira of Pine Ridge	F. J. Cox, Imbil	4,973·35	275·494	Newhills Mascot
Hampstead Gold Star	Cecil Roberts, Harristown	3,893 75	235·281	Kelvinside Favourite's Raleigh
Wyreene Rosella	J. B. Keys, Gowrie Little Plains	4,562·14	233 080	Goldfinder's Prospector of Moray
G. N. Princess	Cox Bros., Maleny	4,132·35	231·707	Retford Royal Atavist

Production Recording—*continued*.

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	FRIESIAN.			
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Oaklands Winana Rock II.	W. Richters, Tingoora	8,155·05	315·066	Pied Rock
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Oaklands Rock Maid III.	W. Richters, Tingoora	8,773·38	303·534	Pied Rock
Oaklands Holly Pearl VII.	W. Richters, Tingoora	7,103·44	254·250	Oaklands Pied Rock 3rd
	RED POLL.			
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Marshlands Marruth Farmer	C. E. McConnell, Marshlands	5,176·17	235·237	Marshlands Farnese

Crown Land for Selection.

YAPPOO EXPIRED HOLDING, HUGHENDEN DISTRICT.
SHEEP LAND.

PORTION 2, parish of Yappoo, 26,000 acres, situated about 50 miles north from Nelia, on the Saxby River, will be open for Grazing Homestead Selection at the Land Office, Richmond, on Thursday, 13th December.

Term of lease, 28 years; rent, 2d. per acre for the first seven years of the term. Provisional valuation of the existing improvements, £412. These consist of fencing and bore drains. The country consists of open undulating downs, well grassed with Mitchell, Flinders, Blue, barley, and other grasses. Generally well shaded.

The land is good sound sheep country, suitable for wool-growing and lambing purposes.

Watered by drains from two bores on Bunda Bunda Holding and by billabongs along the Saxby River. Supplies are ample for the carrying capacity of the block.

Stocking conditions will apply.

Free lithographs and full particulars obtainable from the Land Agents, Hughenden and Richmond; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence Bureaux, Sydney and Melbourne.

PLATE 275.

Members of the 1934 School of Instruction in Pig-raising at the Queensland Agricultural College, Gatton.

Seated in the centre of the front row is Lt.-Colonel A. J. MacKenzie (Chief of the College Veterinary Staff); on his right is Mr. E. J. Shelton (Senior Instructor in Pig Raising, Department of Agriculture and Stock), and on his left is Mr. C. J. McGrath (Supervisor of Dairying, Department of Agriculture and Stock).

PLATE 276.—JUNIOR MEMBERS OF THE BRISBANE LEGACY CLUB.

(On the occasion of an instructional visit to the Department of Agriculture and Stock, 29th September.)

The Legacy Club is an association of ex-service men who have voluntarily assumed the guardianship of war orphans and the sons and daughters of ex-sailors and soldiers who have died or become permanently incapacitated since the war. In this spirit Legacy carries on, overcoming difficulties as they arise, shunning personal publicity, and proving quietly but splendidly that the spirit of the Australian Imperial Force has survived, and is still an effective force in Australian national life.

Answers to Correspondents.

BOTANY.

Replies selected from the outward mail of the Government Botanist, Mr. Cyril White, F.L.S.

Saltbush and Related Plants. Books on Botany.

H.R.L. (Gympie)—

Regarding the family *Chenopodiaceæ*, the following are some common plants in Queensland:—

Old Man Saltbush (*Atriplex nummularia*).

Saltweed or Creeping Saltbush (*Atriplex semibaccata*).

Blue Bush (*Chenopodium auricomum*).

Fish Weed (*Chenopodium triangulare*).

Cotton Bush (*Kochia villosa*).

Galvanised Burr (*Bassia Birchii*).

Fat Hen (*Chenopodium album*).

Books on Australian botany:—

An Elementary Text-book of Forest Botany, by C. T. White. Price, 7s. 6d.

The Story of Our Plants: First Steps in Australian Botany, by Constance M. le Plastrier. Price, 2s.

Intermediate Botany, by A. B. Katley. Price, 2s.

The last two are published by the Shakespeare Head Press, Sydney, but all three books should be obtainable from any bookseller.

"Vegetable Oyster."

M.R. (Toowoomba)—

The specimen is *Tragopogon porrifolius*, the Salsify or Vegetable Oyster, cultivated on account of its edible root. It is very seldom seen in Australian gardens. It is now and again seen as a stray from cultivation on the Downs, and, like chickory and some other plants, when it becomes wild the root is less esculent. We were quite pleased to get the specimen.

Plants from Winton Identified.

R.C. (Winton)—

The specimens have been determined as follows:—

Blennodia trisecta, a herb moderately common in parts of Western Queensland, but we have not heard a common name for it. It should be quite good fodder. The characteristic mentioned—that stock will not eat it until it is dry—seems to be a very common feature among Western Queensland plants. It would probably taint the milk of cows pretty badly, like most plants of the family, but this is not likely to worry you.

Zygophyllum glaucescens, Twin leaf. We were interested in your remarks that sheep eat the plant both green and dry.

Craspedia chrysantha, sometimes called Billy Button. We do not think there is any foundation at all for the belief that this plant causes blindness in horses.

Helychrysum podolepideum, a small species of the Everlasting family. If you could send us a larger specimen of this plant for our collections, the favour would be much appreciated.

Rhagodia linifolia, a plant of the Saltbush family. We should think that stock would eat this plant, particularly when it was drying off.

The Spanish Reed.

E.A. (Wondai)—

The specimen is not Pampas Grass, but *Arundo Donax*, the Spanish Reed, much cultivated as an ornamental grass in Australia and most warm, temperate countries. We have not heard of its being used as a fodder before, and on the whole it seems rather caney. If you are going to plant a small plot for trial purposes, however, it would be as well to cut the plant down every spring and let it shoot forth again. In the Southern States it is commonly called Bamboo, but is not a true Bamboo.

Rough Poppy.

A.W.J. (Lanefield)—

The specimen you send is one of the popics, *Papaver hybridum*, sometimes called the Rough Poppy. So far this poppy has not become a serious pest, at least in the lowland parts of the State. All of the membere of the poppy family are more or less suspected of being poisonous, as several of them contain alkaloids, such as morphine. However, so far as we are aware, no cases of poppy-poisoning have come under notice in this State. It is as well that you destroyed the plants you saw, as we already have too many weeds to cope with. *Papaver hybridum* has been recorded from the Darling Downs and the neighbourhood of Brisbane.

Caustic Vine.

A.F.M. (Hughenden)—

The specimen is, as you supposed, *Sarcostemma australe*, the Caustic Vine. This plant is widely spread through Queensland and Central Australia, occurring from the coast to the far interior. Reports regarding its poisonous character are very conflicting. It has even been spoken of in South Australia as quite good fodder. Feeding tests, however, recently carried out, definitely show that the poisonous properties generally ascribed to the plant in Queensland are founded on fact.

Buttercup Bush.

N.A.R.P. (Toowoomba)—

The specimen represents *Cassia eremophila*, commonly known as Buttercup Bush. It is a native of Western Queensland, is easily propagated from seed, and, we think, is worthy of a place in every garden. There were some fine plants of it growing in the Brisbane Botanic Gardens, but they died out and were not replaced. Like most Cassias, we think it wants replacing every few years.

Grasses Identified.

Fodder Project Club (Pullen Vale)—

Couch Grass (*Cynodon Dactylon*). This grass is widely spread over the tropical and subtropical regions of the world. It is a very nutritious grass, palatable to stock, but does not produce a great body of feed.

Buffalo Grass (*Stenotaphrum secundatum*). A native of tropical America now naturalised or cultivated in most warm countries. At one time it was used very extensively for lawns, but now is not used so much, its place being taken by the Blue Couch (*Digitaria didactyla*). It was one of the grasses grown many years ago on felled scrub areas, but is seldom seen now, except on old settlements, having given way to Paspalum, Rhodes, and other grasses.

Blue Couch (*Digitaria didactyla*). This grass is now very abundant in coastal Queensland. It is quite a good fodder, but is very dominant and apt to overrun pastures on better-class country where Paspalum and other grasses of higher-carrying capacity could be grown.

Red Natal Grass (*Rhynchelytrum roseum*). This is a native of Africa now widely spread over most tropical and subtropical countries. Reports concerning its fodder value are rather conflicting, but we do not seem to have a particularly good strain in Queensland. It is very common as a weed of cultivation on fruit farms in the coastal belt, and makes excellent "chop-chop" for horses and cattle, particularly when mixed with more palatable fodders.

Wild Sorghum.

W.S. (Spring Hill)—

The specimen of grass represents *Sorghum verticilliflorum*, commonly known as Wild Sorghum. It is an African grass, now very common in parts of Queensland, particularly along railway embankments, roadsides, cultivation headlands, &c. It is a perennial, and rather coarse in growth. It should be readily eaten by stock, but is strongly cyanophoric—that is, it contains quantities of a prussic-acid-yielding glucoside. This poisonous glucoside is present in a number of Sorghums, but is particularly marked in the present species. On the whole, its cultivation is not recommended.

Wall Barley.

O.G.S.M. (Warra)—

The specimen represents *Hordeum murinum*, the Wall Barley, a common European grass mostly met with in Queensland as a weed of cultivation. It is commonly seen around horse yards, &c., where feed has been spilt. It is of very little value as a fodder and should not be encouraged.

Sandalwood.

C.E.Y. (Noondoo Siding)—

The specimen bore neither flowers nor seed-pods. The bodies you took for fruit are really insect galls. We should say, however, that it represents the true Sandalwood (*Santalum lanceolatum*). The wood of this tree is largely exported from North Queensland, Thursday Island being the chief port of export. Until recent years we were always under the impression that the Northern tree alone had scented wood, but recently we have seen specimens from Charleville, Dalby, and other places in which the wood was quite scented. In these, however, the trees were very old and large, and the heartwood alone had any marked scent. Small trees, so far as we have observed, have no scent at all—at least, in the southern parts of the State. In Southern Queensland it is not often known as Sandalwood, but is most frequently known as Plum Tree owing to the little plum-like fruits is possesses. It is generally regarded as quite good stock food, and would have more value, we think, in the South from this point of view than for the actual wood. As you know, the name Sandalwood is generally given in Southern Queensland to a totally different tree—*Eremophila Mitchelli*, also found in New South Wales, where it is called Budda. This latter wood has met with no success as a substitute for true Sandalwood, but there does seem some future for it on account of the rich scented oil it contains.

Barbed Wire Grass. Spear Grass. "Black Heads."

T.F. (Goomeri)—

(1) *Cymbopogon refractus*, Barbed Wire Grass. The local name comes from the fact that the spikelets are reversed and occur in clusters along the flowering stem, giving it a superficial resemblance to barbed wire. It is a very common grass in parts of Queensland, but is only of secondary value as a fodder, and is left untouched when more palatable kinds are available.

(2) *Aristida ramosa*, a three-pronged Spear Grass. The local name comes from the fact that the seed is provided with three prongs or awns, which assist the plant in being carried about from one place to another. Aristida grasses are very common in parts of Queensland, and, on the whole, are not of much value as fodder. The spear-like seeds work their way under the skin of sheep.

(3) *Pappophorum nigricans* var. *arenicolum*, sometimes called Black-heads. It is a fairly common grass in some of the mixed native pastures of Queensland, and is probably of secondary importance, although grasses of this type are sometimes of value in making a mixture in the pasture.

Gall Weed. Yellow Daisy. Stagger Weed.

A.J.G. (Duleen, Tara Line)—

Your specimens have been determined as follows:—

(1.) *Zygophyllum apiculatum*, Gall Weed or Twin Leaf. A very common weed that overruns much of the Brigalow country in the mid-West. It is not known to be poisonous, though stock rarely, if ever, seem to touch it.

(2.) *Senecio lautus*, sometimes called Yellow Daisy in Western Queensland. It is very common in some parts, particularly on light forest soils bordering on to the Brigalow country. It seems to be eaten to a limited extent, and is not known to contain any harmful properties.

(3.) *Stachys arvensis*, Stagger Weed, sometimes also called Mint Weed, but not to be confused with the Mint Weed common in the Pittsworth district and to which a good deal of publicity has been directed. As the common name implies, the plant produces "staggers" or "shivers" in stock, but animals have to be driven, worked, or excited in some way before any symptoms are shown. Ordinary resting paddock stock, such as dairy cattle, calves, &c., feed on the plant with impunity.

Sun Hemp.

E.R. (Ambrose)—

Your specimen represents *Crotalaria juncea*, the Sun Hemp, sometimes also known as Rattle-pod, a name applied in general to members of the genus Crotalaria. It is a native weed but is widely spread through the Malayan Region to India. In India a form of the plant is cultivated for fibre, the treatment being somewhat the same as that accorded to flax. It is also valuable as a green manure. We have no record of the plant's effect on stock, but in view of the fact that several members of the genus Crotalaria, both in Australia and abroad, have been proved definitely poisonous to stock, it is as well to regard it with suspicion. We do not think the plant has any economic value in Australia.

Date Palms. Coconut Palms.

A.L. (Gunalda)—

You should be able to obtain date palms and possibly coconut palms from the Curator, Botanic Gardens, Rockhampton, as this institution makes a practice of selling plants. If the Curator at Rockhampton does not have coconut palms, they should be obtainable from the Curator, Botanic Gardens, Townsville. We think this institution also sells plants.

In getting date palms, it is best to get suckers from the female tree, as the male flowers and female flowers are on different trees, the female, of course, only bearing fruit. In the cultivation of dates for drying, the female flowers are generally artificially pollinated, but this is a very simple business. Ordinary dates often come up about places where seeds have been accidentally thrown and really germinate quite well; so if you are not particular about being sure of male and female plants, you could probably raise your own plants from the seeds of ordinary packet dates.

Coconut palms can be raised by placing the whole coconut, including the dry husk, either sideways in the soil or burying about two-thirds or three-quarters under the ground, the sharp end downwards.

Weeds from Gayndah Identified.

W.S.K. (Gayndah).—The Bundle of specimens taken from your farm have been determined as follows:—

(1) *Rumex crispus*, Curled or Yellow Dock. A very common weed in Queensland not known to be poisonous or harmful in any way.

(2) *Stachys arvensis*, Stagger Weed or Wild Mint. This plant is quite a good fodder for dairy cows and ordinary resting paddock stock, but gives working horses or travelling stock "shivers" or "staggers." Animals recover, however, if taken off the plant and put on to ordinary feed. It is not to be confused with the Mint Weed to which so much publicity has been given in the press during the last couple of years, and which is of rather greyish appearance with spikes of bluish flowers.

(3) *Rahpanus Rhapanistrum*, Wild Radish or Jointed Charlock, mostly known in Queensland as Turnip Weed. It taints the milk of dairy cattle very badly, but we do not think it is as bad as Nos. 4 and 5.

(4) *Senebiera didyma*, Bitter Cress or Wart Cress. A very common weed in Queensland and one of the very worst we have to taint the milk of dairy cattle.

(5) *Lepidium ruderale*, a Pepper Cress. Like other members of the family Cruciferæ, it is commonly known in Queensland as Mustard Weed or Turnip Weed. It is a very bad weed to taint the milk and cream of dairy cows.

Nos. 3, 4, and 5 are not known to possess any poisonous properties.

Birds'-Foot Trefoil.

J.B.K. (Kilcoy)—

The specimen is a species of lotus or bird's-foot Trefoil. From the small specimen submitted we should say it was the native species, *Lotus australis*, moderately common in some places and generally regarded as quite a good fodder. In New South Wales it is sometimes called Barwon lucerne. Stock are fond of the plant, but like most of the bird's-foot trefoils it contains a prussic-acid yielding glucoside, although trouble from the plant seems to be very rare.

Pandanus.

C.F.J. (Pialba)—

The common "Breadfruit Tree" of Fraser Island and other parts of the Queensland coast is a species of Pandanus. It is a totally different plant to the true Breadfruit of the South Sea Islands, which is *Artocarpus incisa,* a tree very closely allied to our familiar Jak-fruit. We do not know how the name came to be applied to the Pandanus except that the head of fruits is big and perhaps superficially resembles that of the true Breadfruit. The true Breadfruit or *Artocarpus* is, of course, a very important article of diet on all the islands of the South Seas. There are numerous varieties, the best ones being seedless, and the tree is easily propagated from cuttings. It was introduced into North Queensland some years ago, and there were good trees growing at the State Nursery at Kamerunga, although we have not seen one in Queensland for some time past.

Wall Barley. Whiteheads. Prairie Grass. Hexham Scent. Burr Trefoil. Prickly Lettuce. Improvement of Carrying Capacity.

J.F.K. (St. George)—Your specimens have been determined as follows:—

1. *Hordeum murinum,* Wall Barley; moderately common as a weed during the winter and spring months. It dies out on the approach of hot weather. It provides a bit of food when young, but soon becomes unpalatable and of very little value as a fodder.

2. *Pappophorum avenacea,* Whiteheads; a fairly common grass in parts of Queensland. We were very interested in your remarks that it was ousting the wire grass on the red loam soils on your property. This is very important. The only drawback is that so far as our experience goes *Pappophorum* grasses on the whole are rather unpalatable. What is your experience with the present plant? Could we have a specimen of your wire grass to determine the actual species? The name "Wire Grass" is given in Queensland mostly to the species of *Aristida.* They are very abundant on the lighter soil of the Western Darling Downs and Maranoa districts, and although edible in their younger stages, they soon become harsh and unpalatable. Bullocks will eat them, however, when driven on to them by hunger and the absence of other food.

3. *Bromus unioloides.*—This is the common prairie grass cultivated in Queensland. It is one of the best of the winter grasses, but on the whole seems to want cultivation to succeed well. It is quite a common thing to see it come up spontaneously around homestead gardens. When spread in the brigalow country it carries on for several years, re-seeding itself, but eventually becoming more or less confined to the melon holes.

4. *Melilotus parviflora,* the Melilot or Hexham Scent. Some years ago this plant was boomed as a fodder under the name of King Island Melilot. So far as our experience goes, however, stock do not take to it very readily. It also taints milk very badly if cows feed on it to any extent, but beyond that it does not contain any harmful properties. The seed sometimes contaminates wheat, giving an objectionable odour and flavour to the flour.

5. *Medicago denticulata,* a Burr Trefoil; one of the best of the annual trefoils and clovers. The only disadvantage is that the burrs are troublesome in belly wool of the sheep. Stock on the whole seem to prefer the plant when it is dying off somewhat, to when it is green and luxuriant.

6. *Lactuca scariola,* Prickly Lettuce; rather a bad farm weed in some parts of Queensland.

The question raised by you as to the possibility of improving the carrying capacity of much of the Western Darling Downs and Maranoa districts at present covered by Wire Grasses is an extremely important one and worthy of attention. Some time ago the Department supplied from the State farm at Bungeworgorai a number of roots of Woolly Finger Grass (*Digitaria eriantha*) to Dr. Hirschfeld for the same purpose; that is, the running out of the Wire Grass by another and more vigorous-growing species. Dr. Hirschfeld tells us that the Woolly Finger Grass is doing better on the sandy soils infested with Wire Grass than it is on the heavier black-soil country.

Macrozamia.

J.R. (Yeerongpilly)—

The specimens collected near Springsure represent *Macrozamia Moorei*, very common in that district. Its effects on horses are said to be that they stagger somewhat in their front legs and step high. They eventually go almost blind from the effect of the plant. Trouble is caused in two ways, mostly from stock eating the young plants, and sometimes from their eating the fallen seeds. In cattle the symptoms are somewhat different, rickets and loss of control of the hindquarters being frequent symptoms.

Trees Suitable for the Callide Valley.

O.W. (Biloela)—

Following is a list of trees that should grow in your locality:—Burdekin Plum Mango (worth trying if your winters are not too severe); Coral Tree (Erythrina); Poinciana (the same remarks apply as to the Mango); Jacaranda; Algaroba Bean; Camphor Laurel; Silky Oak; *Celtis sinensis*, deciduous, commonly called Box Elm, in our opinion one of the handsomest trees for a position such as yours and it also has the advantage that the leaves are good fodder for stock; Phytolacca or Bella Sombra Tree, a very quick-growing species with a very spreading, gouty stem; the leaves are quite good fodder for stock; pines of various sorts (probably the best for your purpose would be the long-leaved Chir pine, *Pinus longifolia*, Torulosa Pine, *Cupressus torulosa*), Cotton Palm, *Washingtonia*, Wine Palm, *Coccus Yatay*. The nearest source of supply of young trees would probably be the Botanic Gardens, Rockhampton, and we would advise you to get in touch with the curator. If you wish to raise the trees yourself from seed, the seeds should be sown in flats or prepared beds, then preferably put into pots or old tins and eventually planted out into their permanent situations. It is getting rather late for planting this season, although the more tropical types of plants such as the Burdekin Plum, Mango, Coral Tree, and Poinciana are best planted now.

Windbreaks at Jandowae.

C.W.McG. (Brisbane)—

Regarding trees suitable for growing as a windbreak for dairy stock in the Jandowae district, we think one of the pines would be as satisfactory as any; we take it that a fairly quick-growing tree is required. Of these, we would recommend either the Insignis pine (*Pinus radiata*) or the *Torulosa* pine (*Cupressus torulosa*). Both are obtainable in quantities from most nurserymen. The Torulosa pine is a species of Cypress pine, and varies a good deal in character. For ordinary purposes, such as a windbreak, seedling trees should suffice, but, of course, they do not come true to type. Trees raised from cuttings are more reliable in this respect, but are more expensive.

Woolly Clover.

W.S. (Cooyar Line)—

The specimen represents the Woolly Clover (*Trifolium tomentosum*), an annual clover that is now and again seen growing spontaneously in parts of Southern Queensland. It grows during the winter and spring months, dying off with the approach of the hot summer weather. We have little knowledge of its value as a fodder, but most of these annual clovers are of value as they come in at a time when grass is short.

Bitter Pitted Blue Grass. Rat's Tail Grass.

T.G. (Nerang)—Your specimens have been determined as follows:—

1. *Bothriochloa decipens*, Bitter or Pitted Blue grass, also known as Red-leg or Red grass. Our general experience with this grass is that it has very little value as a fodder, and stock do not take to it unless driven by hunger or absence of other feed. The Blue grass about Miles you refer to is *Dichanthium sericeum*.

2. *Sporobolus Berteroanus*, Parramatta grass or Rat's Tail grass, a native of South America now naturalised in most warm temperate countries. It has caused some concern in some of the coastal districts as an invader of the Paspalum pasture.

Cockspur Thistle ("Saucy Jack.")

W.B. (North Tamborine)—

The specimen represents the Cockspur Thistle (*Centaurea melitensis*), a native of Southern Europe, now a common naturalised weed in many warm temperate countries. We think it is much more abundant in the Southern States than in Queensland, and here it is mostly found on the Darling Downs. It is a very bad weed in parts of New South Wales, and is commonly called "Saucy Jack." The plant is said to have some fodder value in its younger stages, but to be soon neglected by stock. Its destruction is recommended.

European Bindweed.

H.J. (Stanthorpe)—

Your specimen represents *Convolvulus arvensis*, the European Bindweed, a particularly pernicious pest once it gets into cultivation. It is fairly common in some of the Southern States, but up to the present it has not much of a hold in Queensland. We have had a few specimens from the Darling Downs, but this is the first time from the Granite Belt. Every effort should be made to eradicate it. A leaflet on the weed has been posted to you.

Yellow Dock.

M.D.O'D. (Gympie)—

The specimen represents *Rumex crispus*, the Yellow Dock or Curled Dock, a common European plant now abundant as a naturalised weed in many parts of Australia. It is quite a common weed in Queensland on cultivation areas and waste places such as town allotments, &c. It is not known to possess any harmful or poisonous properties.

English Meadow Grass.

E.G.T. (Maleny)—

The specimen is *Poa annua*, the English Meadow Grass, a common European grass now fairly common in many parts of Queensland. It is particularly abundant during the late winter and spring months, and dies out on the approach of hot weather. It is quite a useful fodder while it lasts. It is more often seen as a weed of cultivation than in the pasture, although of recent years it seems to have invaded some of the pastures in the coastal belt.

Canary Grass.

C.A.M. (Cooroy)—

The specimen represents the common Canary Grass (*Phalaris canariensis*). This grass is mostly grown for canary seed rather than as a fodder. Two other Canary Grasses are grown in Queensland, namely *P. minor* (annual) and *P. tuberosa* (perennial). The latter is an excellent fodder grass, especially valuable during the winter months. Seeds of Canary Grass should be sown preferably in April or May.

Useful Shrub for Coastal Lands (*Vitex trifolia*).

A.C.H. (Bowen)—

The shrub *Vitex trifolia* is a common native seaside shrub in Queensland. It is a particularly valuable shrub for planting in coastal areas to stop sand drift. There are several forms in North Queensland; one creeps over the sand, and this form is very abundant on the esplanade at Townsville; you probably also have it at Bowen. The form most favoured for planting is a shrubby one generally growing about 6 to 8 feet high. The leaves are green above and generally whitish beneath. The flowers are blue, the berries at first green and eventually black. It can be propagated from seed, but should strike quite readily from cuttings. A variegated form, variety *variegata*, is moderately common in Queensland gardens. In regard to the roots you have, if you want to make a hedge of these I would plant them about 3 feet apart. The present time is a very suitable one for doing the work, but if the weather is at all dry the plants should be kept watered and preferably mulched for a week or more after planting.

Johnson Grass.

W.P.C. (Roadvale)—

The specimen represents the Johnson Grass (*Sorghum halepense*), mostly seen in Queensland as a weed of cultivation. When once it gets into a cultivation it is difficult to eradicate. It is a moderately good fodder, but like other members of the Sorghum family contains a prussic-acid yielding glucoside, and therefore must be fed with care. Cutting and allowing the plant to wilt renders it safer. Pigs are very fond of the white underground runners, and though they are often eaten by them without harmful results we have heard of cases of death resulting, as these runners contain the same poisonous principle as the green leaves.

"Wild Lucerne." ***Sida retusa.***

T.G. (Nerang)—

The Wild Lucerne of Brunette Downs is *Psoralea cinerea*, a native of the Northern Territory and North-western Queensland. It is much more of a lucerne-like plant in appearance than the *Stylosanthes*, growing upright and not trailing along the ground. The so-called Wild Lucerne of Darwin is the same as the "Townsville Lucerne." The correct botanical name is *Stylosanthes sundaica*, the other name (*Stylosanthes mucronata*) being merely a synonym. By the rules of botanical nomenclature the name *sundaica* has priority and has got to be used. We hope this clears up the matter.

Sida retusa is quite a good stock feed, although I do not know that it has been analysed to find its actual food value. In parts of New South Wales it is very abundant, and is commonly known as "Paddy's lucerne." I do not know that it would have any effect on stock. The leaves are somewhat mucilaginous when chewed and may assist in passing dry fibrous food. The stems of *Sida retusa*, of course, are exceedingly fibrous.

Henbit or Dead Nettle.

J.B. (Chinchilla)—

The specimen represents *Lamium amplexicaule*, the Henbit or Dead Nettle, a common weed of the Northern Hemisphere now quite common in many parts of Queensland and the Southern States. It is closely allied to the common Stagger Weed, and like that plant is capable of causing "shivers" or "staggers" in stock. The animals, however, have to be worked, driven, or excited in some way before any symptoms are manifested. For ordinary paddock resting stock such as calves and dairy cattle the plant is quite good fodder.

Whitewood and "Walk-about" Disease.

C.W. (Butcher Hill)—

The Whitewood is a small tree fairly abundant in many parts of Queensland, stretching through the Northern Territory to the Kimberleys in Western Australia. We have posted you under separate cover a small branchlet showing the leaves. The tree bears a mass of small white flowers, and these are followed by very characteristic winged "seeds." It would be interesting to know if this tree occurs in your locality. Although the case seems definitely proved against Whitewood, many stockowners and veterinarians are of the opinion that Whitewood is not the only cause of the "Walk-about" disease common in parts of Northern Australia. One of the reasons given for this is that "Walk-about" disease occurs where Whitewood is absent or at most rather rare.

A Common Pasture Herb.

H.P. (Kolan River South)—

The specimen is *Geranium dissectum*, a very common pasture herb in Queensland and New South Wales. On the Darling Downs and inland pastures generally it is most frequently referred to as Crow's-foot, and is favoured by sheep. In addition to the leafy foliage the older plants possess a small, carrot-like root which is relished by stock, particularly sheep. The herb is sometimes seen in the mixed native pastures on the coast, but stock do not seem to take to it readily as they do in the inland parts of the State. Perhaps the plant makes a ranker growth on the coast, and is consequently less palatable.

General Notes.

Staff Changes and Appointments.

Mr. A. E. Mitchell, Slaughtering Inspector, Warwick, has been appointed also an Inspector under the Diseases in Stock Acts.

Mr. A. J. Hicklin (Sandgate) and Mr. E. L. T. Boyce (care Main Roads Commission, Brisbane) have been appointed Honorary Rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. C. P. Joyner, Inspector of Stock, Cooyar, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. J. Wyvill, Inspector of Stock, Nanango, has been appointed also an Inspector under the Slaughtering Act.

Mr. E. R. Boyd, Inspector of Dairies, Nanango, has been appointed also Inspector under the Diseases in Stock Acts.

Mr. P. P. Comiskey, Inspector of Stock, Boonah, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. T. Brett, Inspector of the Moreton Rabbit Board, attached to Mount Lindesay, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. E. R. Cronau (Newmarket) has been appointed an Inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. R. B. Norwood, Assistant Pathologist, Department of Agriculture and Stock, has been appointed also an Inspector under the Diseases in Plants Acts.

Mr. G. W. J. Agnew, Inspector under the Diseases in Plants Acts, has been appointed also an Agent under the Banana Industry Protection Act.

Messrs. J. J. Shelvey and J. Bishop, Inspectors of Stock at Helidon and Kingaroy, respectively, have been appointed also Inspectors under the Slaughtering Act.

Messrs. J. A. O'Neill and D. J. Callaghan, Dairy Inspectors at Gayndah and Mundubbera, respectively, have been appointed also Inspectors under the Stock and Slaughtering Acts.

Mr. J. P. Dowling, Stock Inspector, Gayndah, has been appointed also an Inspector under the Dairy Produce Acts.

Mr. R. E. Watson, Inspector under the Stock, Slaughtering, and Dairy Produce Acts, has been transferred from Toowoomba to Goombungee.

Mr. J. Macdonald, of Ayr, has been appointed an Honorary Ranger under the Animals and Birds Acts in connection with the recently declared sanctuaries on Hamilton and Henning Islands.

Mr. A. M. Richardson (Burleigh Heads) has been appointed an Agent under the Banana Industry Protection Act and Inspector under the Diseases in Plants Acts, and will be stationed at Stanthorpe.

Senior Sergeant G. P. Keeffe (Warwick) and Acting Sergeant O. Murphy (Esk) have been appointed also Inspectors under the Slaughtering Act.

Mr. E. G. Lawrance (Maleny) and Mr. E. Teitzel (Mount Mee West) have been appointed Honorary Rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Constable C. J. Munro (Nebo) has been appointed also an Inspector under the Brands Acts.

Mr. H. Collard, Assistant Instructor in Fruit Culture, has been transferred from Cardwell to Maryborough.

Election of Mill Suppliers' Committees.

Existing regulations under the Primary Producers' Organisation and Marketing Acts relative to the election of Mill Suppliers' Committees and District Cane Growers' Executives have been rescinded, and new regulations issued in lieu thereof. The present method of optional preferential voting for Cane Growers' Association elections is considered unsatisfactory, and accordingly new regulations providing for a system of compulsory preferential voting have been promulgated.

In Memoriam.

KEITH LOCKWOOD GRAHAM.

The announcement of the death of Mr. Keith Lockwood Graham on 11th October was received with profound regret in the several country districts of Queensland in which he had served as manager of branches of the Bank of New South Wales.

The late Mr. Graham was the first manager of the Bank of New South Wales at Murgon, then little more than a name on a railway map. In the early days of that fertile and now very prosperous section of the rich South Burnett, he was among the pioneers of every progressive movement and an influence for good in the business and social life of the youthful community, assisting greatly in its rapid development. As a capable banker and as a guide, philosopher, and friend to the pioneer settlers, his worth was widely recognised.

Mr. Graham was afterwards appointed to the management of the Cooktown and Samarai branches of his bank. In 1922 he was transferred to Eumundi, where he remained for eight years. On 11th October, 1930, an attempt was made by armed burglars to rob the bank. With remarkable coolness and courage, Mr. Graham frustrated the attempt, but was shot twice and dangerously wounded. (It is a coincidence that he died on the corresponding date four years later.) On recovering he was transferred to the Brisbane district relieving staff, and later to the position of manager of the Mount Gambier branch, South Australia. He was afterwards appointed relieving manager in Victoria. Not long ago he became ill and returned to Queensland. He was fifty-five years of age, and unmarried.

Mr. Graham belonged to a well-known Queensland family, who were pioneers in the pastoral industry. He was a native of the Darling Downs, and was educated at the Toowoomba Grammar School. A brother was among the first Australian Light Horse officers to be killed at Gallipoli.

Mr. Graham was a fine cricketer in his younger days, and played for Toowoomba against the late A. E. Stoddart's English Eleven. He also excelled at tennis. To his bereaved relatives deep sympathy is extended.

Slaughtering Regulation.

Regulation No. 39 under the Slaughtering Act has been reissued in a form which now makes it quite clear that the occupier of a butcher's shop shall be the person responsible for seeing that the shop is provided with wire gauze to exclude flies, and to ensure that the doors are kept closed except when in use for ingress or egress.

Hail Insurance.

An amendment of the Hail Insurance Scheme Regulations issued under the Wheat Pool Acts has been approved which will provide that returns for hail compensation shall be lodged with the Wheat Board on or before such day, but not later than 15th September in the year in which the crop is grown, as the Board may determine. The regulation previously provided that returns should be lodged on or before the 15th August in each year.

The Broom Millet Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, giving notice of intention to extend the operations of the Broom Millet Board for the period from 1st November, 1934, to 31st October, 1937. A petition on the question of the continuance or otherwise of the Board may be lodged by growers on or before the 24th September, 1934.

Deloraine Island a Sanctuary.

Deloraine Island, near Whitsunday Island, Great Barrier Reef, has been declared a sanctuary under the Animals and Birds Acts.

Rolleston-Injune Road a Stock Route.

An Order in Council has been issued under the Diseases in Stock Acts, declaring the Rolleston-Injune road to be a stock route for the purposes of the said Acts. This road was recently opened, by Proclamation under the Lands Acts, as a public road, and may in future be used as a stock route for travelling stock.

The Pig Industry Act.

Executive approval has been given to the issue of a Proclamation bringing "*The Pig Industry Act of* 1933" into operation as from the 23rd August.

Regulations have been approved under the Act, and these cover the examination of graders and inspectors, the grading of carcasses, the management of piggeries, grade definitions, grade certificates, check grading, grade marks, and condemnations.

Tobacco Pure Seed District near Rockhampton.

An Order in Council has been issued under the Tobacco Industry Protection Act constituting a Tobacco Pure Seed District which comprises the area contained within the boundaries of the parishes of San Jose and Ultimo, in the county of Deas Thompson. This district embraces Marmor and Bajool, near Rockhampton.

Sanctuaries in Whitsunday Passage.

An Order in Council has been issued under the Animals and Birds Acts declaring Hamilton and Henning Islands, Whitsunday Passage, to be sanctuaries under the Animals and Birds Acts. It will be unlawful in future to shoot any native animals or birds on these islands.

Provisional Maize Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts amending the constitution of the Provisional Maize Board by extending the term of the Board for a further twelve months. The Board was constituted in October, 1931, for twelve months, and was extended for a similar period in November, 1932.

Fruit Fly in Granite Belt.

A Proclamation has been issued under the Diseases in Plants Acts declaring the Stanthorpe, Killarney, and Warwick districts to be a quarantine area on account of the disease of fruit flies. A Regulation has also been approved under the Acts prescribing the nature of the quarantine to be imposed therein. It will be necessary for orchardists in the districts mentioned to place traps charged with fruit fly lure approved by an Inspector throughout their orchards. The regulation will be in force for the period from 8th October, 1934, to 28th February, 1935.

Citrus Fruit Lands of the Burnett.

The Minister for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.) stated recently that he had received a report from the Director of Fruit Culture (Mr. H. Barnes) covering a survey of the Mundubbera district from the aspect of commercial citrus growing.

The report indicated that along the banks of the Auburn, Boyne, and Burnett Rivers there are many acres of suitable citrus soils, ranging from deep sandy soils to chocolate and redy sandy loams. Where the subsoils are of sufficiently open texture to obviate any danger of the retention of excessive moisture, the loamy soils are to be preferred. Good supplies of river water are available for irrigation, without which the cultivation of this fruit should not be attempted in the drier regions.

On the Curgeena and Binjour plateaux the soils are mainly chocolate and red loams, but as there is an absence of water and the rainfall is irregular and insufficient commercial orchards should not be planted.

Of course, added the Minister, every care should be exercised by intending orchardists when determining the site of the grove, and in this connection planters would be well advised to seek the advice of Departmental Instructors, who are always willing to assist in every possible way.

The varieties recommended for the main plantings are Washington Navel and, to a lesser degree, Valencia Late. In warm situations free from frost the Villa Franca and Lisbon Lemons will do well, as also will the Beauty of Glen Retreat Mandarin.

Rural Topics.

Care in Handling Pigs.

Under normal conditions around the farmyard, and all other things being equal, it is reasonable to consider the domestic pig as being of even, contented temperament —an animal, who, though stubborn by nature, is easily handled if given reasonable care. A report published recently of a young man at Skyring's Creek, Pomona, being attacked by a boar and receiving nasty wounds as a result of the boar using his sharp tusks and teeth too freely indicates the urgency of being ever careful when feeding and attending to this class of animal. No mention was made of any extenuating circumstances in the case referred to, but it often happens that a boar pig (in particular) comes in for rather bad treatment at the hands of farmers who are short-tempered themselves, and thus when both the attendant and the animal become excited an accident is almost certain to occur, and, if it does, the strongest and the quickest wins. Boars should not be permitted to run with sows and other pigs, but should be kept in a properly constructed boar yard, into which no one should enter without providing himself or herself with a stout cane with which to protect one's self if need be.

It is an offence under the Pig Industry Act to ill-treat a pig in any way and to beat a pig with a whip, stick, or other instrument capable of bruising or damaging the carcass of such animal; hence the added necessity for care in handling, to avoid any call for rough treatment on the part of either man or beast. If reasonable precautions are observed, there is little risk of trouble. However, it is a wise procedure, and not an impossible one, to remove the sharp tusks of the boar pig before he reaches the age of one year, or to remove them if they have grown and the animal is over twelve months of age. A pair of blacksmith's bolt-cutters is the safest and best instrument to use in removing the tusks, and to do this, of course, necessitates tying the animal up to a very stout post or rail. It is a very wise thing to nip off the sharp black teeth of sucking pigs before they are one month old, for, although they are only small, they can do a great deal in irritating the sow if they fight, and lacerate her teats with the sharp black teeth which they possess. After removal of the tusks or teeth, ordinary care only is necessary to prevent infection.—By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

Triumph of Herd Testing.

All thoughtful and far-seeing dairy farmers have always rightly believed that persistent herd testing was the main foundation of successful dairy farming. Further proof of that contention has just come to hand from the South Taranaki Association, and it reveals a success of which any association in the world might be justly proud.

Not so many years ago an occasional average record of 300 lb. butterfat per cow was considered a wonderful result; but the South Taranaki Association has been aiming at an average of all cows tested within its bounds of 300 lb. It was a great object, thought by many to be unattainable, but it was successfully attained last season. The result is all the more remarkable for the reason that a fair number of cows did not yield a great deal more than 200 lb. of butterfat each.

Herd testing is a fruitful source of many desirable changes in dairy farm management, not the least important being the stimulation of the competitive spirit. Great results from one association spur others to make greater efforts, and, hence, are a source of all-round improvement. A general improvement in herd treatment is brought about, as it is soon realised that an increase in the herd average yield is not possible except there is first a general improvement in the management of the herd. It necessitates greater care in breeding, feeding, culling, sheltering, pasture topdressing and general pasture management.

Unfortunately the prospect of quotas or other restrictions on the export of butter, cheese, and by-products of the dairy farm may cause great discouragement to many farmers, and induce them to conclude that higher butterfat averages are of little value when the increase cannot be marketed. That such a conclusion is wrong should be obvious; indeed, the effort to bring about a higher average production should be intensified, not to increase the quantity of produce for export, but to enable farmers to decrease the number of cows in their herds very considerably, so that part of the land would be available for some other branch of farming; or, in other words, so that twenty cows would produce the quantity of butterfat that is now produced by twenty-five to thirty.—Primrose McConnell in the "New Zealand Farmer."

Cultivation of Maize.

In the production of maize the cultivation of the growing crop is essential for two main reasons—firstly, for the destruction of weeds, and, secondly, for the conservation of soil moisture. Harrowing the young crop is the first necessity, as it destroys young weed growth, particularly in the rows, aerates, warms and mulches the soil, and gives the young plants a quick start. As the crop grows it should be inter-row cultivated whenever weeds appear or the soil becomes crusted.

The depth of cultivation is very important. Cultivation of the established plants must not be too deep. No harm is done if deep cultivation is practised in the early stages of growth, provided it is not too close to the plants, but from when the plants are 18 to 20 inches high only shallow cultivation should be given, as, the plant being a surface feeder, the roots extend across the rows and within 3 or 4 inches of the surface.

The disadvantages of hilling outweigh the advantages, and as a general practice it cannot be recommended. A light hilling may sometimes be necessary to smother weed growth or as an aid to drainage on low-lying lands, but the damage done to roots, the possibility of ''gullying'' on slopes, and the greater surface exposed for evaporation are all against the practice, while the support given to the stalks by hilling is not so important as is usually thought. Throwing a big hill with the plough as still often practised cannot be too strongly condemned.

It is not necessary to remove the suckers from growing maize crops. This practice, adopted by many farmers with the idea of increasing yield and incidentally providing a little fodder for stock, actually decreases the yield, as proved in an experiment conducted at Grafton Experiment Farm (New South Wales) over a period of four years.

Safe Working of Farm Machinery—Some Vital Safeguards.

An accident which occurred recently to a young girl, whilst she was attending a power-driven separator on her father's farm, draws attention to the necessity for the adequate protection of milking machinery. This girl was partly scalped through her hair, which she was wearing long, being caught up by a belt, only 1 in. wide, transmitting power to the separator. In another case, it was found necessary to amputate the left leg of a man who had been caught in the belting of a milking machine.

Moving belts are responsible for most of the accidents with milking machinery. Often the victim is struck by the projections on metal belt fasteners, or is trapped at the intake of the belt with the pulley.

All belting within reach from the floor should be fenced. The habit of shifting belts by hand is dangerous. The use of a belt pole or stick is less dangerous, but mechanical means for shifting the belt are the safer. If metallic fasteners without dangerous projections cannot be obtained, the most convenient, and at the same time, a safe fastening, is a well-made leather-laced joint. Perches or hangers should be provided for belts in order to prevent them riding on the shaft when they are unshipped.

Another hazard of milking machinery is revolving shafting. Whilst shafting accidents are not so frequent as belting accidents, they are the more serious, and several fatalities and serious accidents have occurred. Many people are deceived by revolving shafting because it looks so smooth. However smooth it is it is capable of catching up anything loose, such as, for instance, aprons, ragged sleeves, hair, cleaning waste, &c. The hazard of revolving shafting is greater at higher speeds, but fatal accidents have occurred at shafts running at a few revolutions per minute. All exposed shafting, or shaft ends, should be protected, and projecting key heads in couplings and pulleys, projecting bolt heads and nuts in couplings, projecting set screws on shaft collars, and all other projections liable to catch in clothing should be eliminated or protected, unless they are out of reach and, therefore, safe by position. No shafting is considered safe by position, unless it is at least 6½ ft. above the floor, or from any point to which persons may have access whilst the shaft is in motion. The arms of wheels and pulleys within reach should also be fenced, or fitted with solid discs. Gear wheels should be encased in metal guards; partial guards are inadequate and may be dangerous.

There appears to be a general impression that, as all small farming machinery is exempt from inspection under the Inspection of Machinery Act, the owner is not legally obliged to guard it. This impression is quite erroneous. Any owner of power-driven milking machinery who permits any moving part of it to be used without being so guarded as to afford adequate protection to all persons working the machinery, or who may be in the vicinity thereof, is liable to a fine not exceeding twenty pounds. Further, an Inspector of Machinery has power to require the owner to desist from working or using any milking machine which is defective, or insufficiently fenced or guarded, until the requirement of his Department have been complied with.

If farmers wish to be completely successful in the prevention of accidents, it is necessary that they should supplement the provision of mechanical safeguards with a strict enforcement of certain rules of safe practices in the working of machinery. Some of the most important of these rules are:—

1. Never reach into moving machinery.
2. Stop the machine if it is necessary to approach any moving part which is not guarded or fenced.
3. Do not ship or unship moving belts directly by hand.
4. Do not permit loose belts to rest on revolving shafting.
5. Do not oil bearings in the vicinity of unfenced belts, shafting, or gear wheels, when the machinery is running.
6. Do not clean shafting, examine, or repair machinery when it is in motion.
7. Wear safe garments when attending moving machinery. A single-piece, close-fitting suit of overalls is safer than overalls consisting of separate coat and trousers. Pockets should be few and small, and sleeves should be tight at the wrist. If sleeves are not desired, they should be removed at the shoulder, or at the place to which they would be rolled up. If removed, the edges should be hemmed. Sleeves should not be worn rolled up because they then offer considerable resistance if caught in machinery. Do not wear loose or ragged clothing; nor loose aprons; neckties, if worn, should be enclosed.
8. Insist on any woman or girl working at milking machinery having her hair put up or enclosed in a net.
9. Never allow children to enter the shed in which the milking machinery is installed. Keep the door locked and the key out of their reach.
10. Even though the machine may be a small one, do not be careless when attending it.

The above precautions are, in the light of present-day experience, essential if accidents are to be prevented. The accident hazard of farm machinery is greater than it is generally supposed to be. A "safety first" policy will pay financially and socially. A moment for safety is better than a month in bed for repairs.—The "New Zealand Farmer."

Importance of a Good Bull.

A sire of unquestionable quality is essential if dairying is to be carried on with maximum profit. Referring in the course of his report, a judge of a recent North Coast (N.S.W.) dairy farm competition observed:—The herds seen were generally of a high standard as regards quality and type. It is very disappointing, however, to see so many farmers using herd sires which have no direct production backing. This requirement has been given publicity and advocated for so long that failure to observe it cannot be a matter of ignorance, yet the dairy farmer who places at the head of his herd a sire from untested stock is deliberately taking a thousand-to-one chance of his being able to improve the herd's average butter production.

Some farmers in the competition have carefully culled and tested their herds for years, bringing them to a fairly high standard, and then purchased a pure-bred bull from an untested dam, thus risking the work and expense of years. To "breed, weed, and feed" is an old slogan in the dairying industry, but no two of these three practices are of their full value without the other one.

How to Renew Old Cultivator Points.

Do not throw away your old cultivator points, for with a little attention they can be made as good as new again, a correspondent advises fellow-farmers in the "Agricultural Gazette" of New South Wales. Put them in the forge, heat to a nearly white heat, flatten out portion of the turned-up parts, and cut sides down to a V-shape. Then sharpen (by hammering) the cutting edges, like a wood-chisel, heat in the fire until a *slight* tinge of red appears in the steel, then immerse in sump oil for about half a minute and throw out to cool. This will give just the right temper—tough and hard. For very worn points, punch a new hole near one end, and they will be nearly as good as new.

Make your own cultivator points from old discs; there is nothing better, and they will outlast two sets of bought ones.

How to Cut a Rafter.

Many a farmer, in building any of the various small farm buildings, has no difficulty until he comes to laying out the rafters. Yet this is not a very hard matter once one takes a little time to think the problem through.

First, we should get clearly in mind the parts of the rafter. The first illustration herewith will make this clear. The plumb cut is where the two rafters meet at the peak of the roof. The seat cut is where the rafter rests on the wall plate. The plumb cut is always vertical, the seat cut is always horizontal.

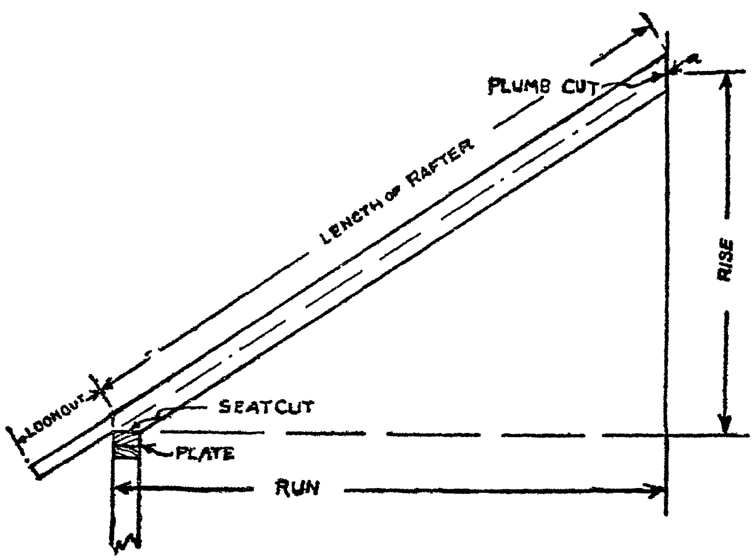


PLATE 277.

The run is the horizontal distance under the rafter, while the rise is the vertical height from the plate line to the point where the dotted line which touches the outside corner of the plate passes at "A" through the plumb cut. The run is half the width of the frame of the building. The term "length of rafter" refers to that part which covers the building, while the lookout is that part which projects beyond the side of the building.

Let us now take a practical problem and lay out a common rafter. All that is necessary is a steel square and a sharp pencil. Suppose we are building a garage 12 feet wide and want to use a ⅓ pitch roof. The rise of the rafter will be ⅓ of 12, or 4 feet, and the run will be 6 feet. If the rise is 4 feet, or 48 inches, for a 6-foot run it will be ⅙ of 48, or 8 inches for each foot of run. This, then, gives us the figures for applying our steel square to the 2 by 4 rafter. First lay off the plumb cut by placing the square on the 2 by 4 so the 8-inch and 12-inch division are in line with the upper edge of the rafter, as shown in "A" in the first sketch. Then make a fine mark at the 12-inch division and transfer the square so the 8-inch division coincides with the first 12-inch mark made on the rafter. Make as many

transfers as there are feet in the run, and the last 12-inch pencil mark will be directly above the outer edge of the studding. Now slide the square farther down, keeping the 8 and 12-inch divisions on the upper edge of the rafter, and mark off the seat cut to the desired depth.

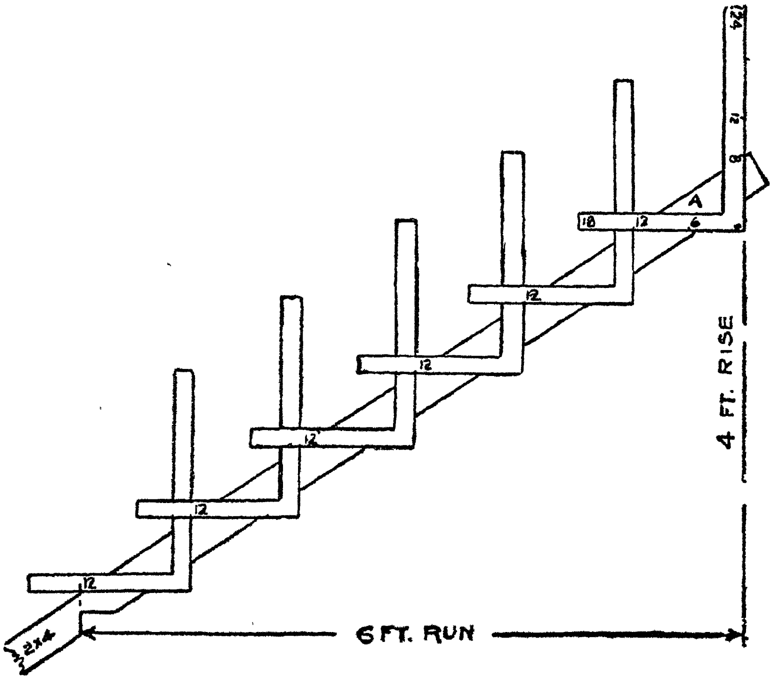


PLATE 278.

The transfers and marks must be very carefully made to get accurate results. Also choose 2 by 4 that is absolutely straight. After carefully sawing out one rafter, it can be used as a pattern for the rest.—"Farm and Ranch."

The Australian Nut—Method of Roasting.

The Australian nut is becoming deservedly popular, but with some types there is a difficulty in breaking the tough shell, and an even greater demand may be anticipated for this nut when the shelled kernels are more widely marketed, either fresh or roasted.

When roasting, the nuts must be fully matured if the best results are to be obtained. The kernels containing the highest oil content give a better-flavoured product than those with a low percentage of oil. The latter are liable to darken or char during the roasting process.

To determine which nuts are suitable for roasting, the specific gravity of the kernels is roughly tested. The dividing line is around a specific gravity of 1; kernels with a specific gravity of less than this have a higher oil content, and contain less sugar. The fresh flavour of the two types is quite distinct. Generally speaking, the smooth-shelled nut has more oil and less sugar than the rough-shelled nut, and it is a more desirable type to grow.

Some trees produce nuts that have bitter kernels. Care should be taken that these are not included in the nuts offered for sale.

The kernels are air-dried in the shell before the nuts are cracked; they are then dried at a temperature of 175 degrees Fahr. for four hours in an oven through which a fair draught of air is continually passing. The kernels are then roasted for forty-five minutes at a temperature of 270 degrees Fahr., and allowed to cool, and gum arabic (10 grammes to 100 c.c. water) is applied. Salt is sprinkled over the kernels, which are then finally dried for a short while at 150 degrees Fahr.

To cook the kernels in vegetable oils, first dry as described, and then cook in the vegetable oil for fifteen minutes at 280 degrees Fahr.—A. and P. Notes, N.S.W. Department of Agriculture.

Cementing a Worn Tank.

A lasting method of repairing corroded iron tanks is to coat them with cement "compo." The method described will be found efficient, and the resultant tank will be strong, rust-proof, and indestructable. The tank must be thoroughly cleaned of all mud and foreign matter both inside and out. Holes are punched in the walls.

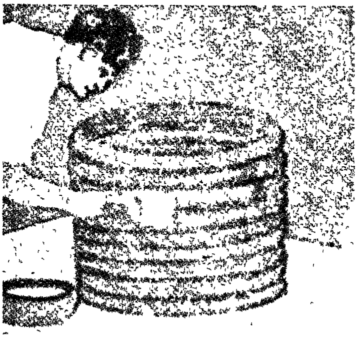


PLATE 279.

These holes should be approximately half an inch in diameter and spaced about 12 inches apart. Small mesh wire netting of half-inch mesh and 22-gauge is then lapped around the tank both inside and outside, the layer for the bottom overlapping on the walls about 6 inches, both layers being laced through the holes, using fine tie wire. In the case of a large tank, the bottom must be plastered first, overlapping the walls about 6 inches, and allowing to harden so as to provide a foothold when plastering the walls. Before plastering, the tank is treated with a neat cement wash, thrown on to the surface by means of a brush. This is to

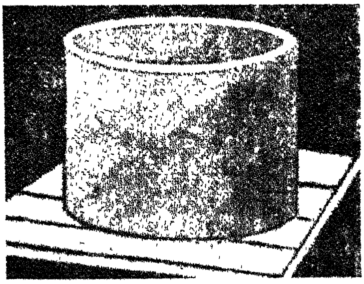


PLATE 280.—CEMENTED TANK.

provide a bond between the tank and the plaster. Now mix a mortar of one part cement to two parts fine clean sand with only enough water to form a stiff but workable mix. Apply in thickenesses of ½-in. When almost hard, score surface to provide bond for next coat. Allow each coat to harden, then damp cure for two days. Thoroughly moisten each coat before application of succeeding coat. Cure finished work for seven days before using. The finished tank combines a neat appearance with strength and utility.

A tank of 6 feet in diameter, 6 feet deep, having a capacity of 1,060 gallons before treatment, would have its capacity reduced to 970 gallons after repair to concrete walls and bottom 2 inches in thickness. Quantities of material required would be 11 cubic feet of cement and 22 cubic feet of sand. A paper bag of cement contains 1⅓ cubic feet. A tank 12 feet in diameter, 6 feet deep, having an original capacity of 4,230 gallons, would require a 3-inch cement wall and bottom. Its capacity when repaired would be 3,880 gallons. Materials required: 39 cubic feet of cement and 79 cubic feet of sand.

Feeding for Butter-fat Production—No Grass or Legume "Best."

Each component of the mixed pasture which is desirable for the feeding of dairy cows has its value, and it would be invidious to speak of any grass or legume as "best," points out an article in the "Agricultural Gazette" of New South Wales.

In indicating the impossibility of accurately compiling such information, attention is called to the fact that the percentage of butter-fat in the milk of any animal depends to a far greater degree on the inherent ability of the particular breed or strain to give high-quality milk than on the quality of feed given. Any increase in butter-fat production would be due to increased quantity of milk produced, and not to improved quality.

Moreover, the effect of any particular plant on the nutritive ratio and nutritive value of other plants with which it is likely to be found in association must also be borne in mind. Whereas, for example, a roughage and a concentrate in certain proportions may form an excellent milk-producing diet, yet it cannot be stated that one or the other has superior value, since each would prove unsatisfactory if fed alone. Thus it is only possible to indicate in a general way which plants possess high nutritional values and to indicate in what proportions admixture is desirable.

Referring to the grasses usually recommended for parts of the North Coast (N.S.W.), namely, paspalum, perennial rye grass, cocksfoot, *Phalaris tuberosa*, tall oat, prairie and Italian rye grass, it was pointed out that at similar stages of growth all were practically of equal feeding value.

Paspalum as a sole item of diet is lacking in both protein and phosphorus, but it can nevertheless be an excellent pasture plant when growing in conjunction with white clover, red clover, subterranean clover, trefoils, or other luguminous plants rich in those constituents lacking in paspalum. Such grasses as the spear, wire, Parramatta, and carpet are quite definitely undesirable, due to high fibre content and low digestibility and protein content.

In regard to the legumes, the best plan to adopt is to utilise those which succeed best in the particular area under consideration, since all legumes are high in protein, lime, and phosphorus content. Presuming that good methods of pasture management are used, a suitable proportion is approximately 65 per cent. of high-quality grasses and 35 per cent. of legumes.

Management is such an important factor controlling pasture value that it must be as carefully considered as the species present. In the case of all plants used for grazing purposes, it has been found both by analytical methods and by field experience that after the plant has passed a certain stage of growth its value as feed declines rapidly, till at maturity it is far below the earlier level. For example, at Berry Experiment Farm (N.S.W.) cuts taken when the young pasturage was 4 inches high and cuts of mature (flowering) pasture of the same botanical composition gave chemical analyses as follows:—

—	Immature Pasturage.	Mature Pasturage.	Percentage increase of immature over mature Pasturage.
	Per cent.	Per cent.	Per cent.
Protein	10·481	8·044	30·3
Lime (CaO)	·428	·337	27·0
Phosphoric Acid (P_2O_5) ..	·474	·446	6·3

These figures are from a good pasture. Where undesirable species are present the effect is much more marked, due to the high fibre content of the mature plants.

Hence, whereas a pasture when 4 inches high may be quite ideal in its feeding qualities, precisely the same botanical mixture is likely to be too low in protein content when allowed to reach maturity. The inferior value of tall, rank paspalum compared with a short, quickly-growing cover of the same grass is well known.

Thus, to increase milk yield and with it the butter-fat yield, it is vital that the farmer adopt such a system of management as to keep his stock continuously on young pasturage. This can be achieved satisfactorily only by subdivision of the paddocks to such a size as to permit a system of rotational grazing with brief but heavy stocking of the paddocks successively.

The Prayer of the Horse.

"To thee, my master, I offer my prayer.

"Feed me, water, and care for me, and when the day's work is done provide me with a shelter and a stall wide enough for me to lie down. Talk to me. Your voice often means as much to me as the reins.

"Do not whip me when going uphill. Don't beat or kick me when I do not understand what you mean, but give me a chance to understand you. Watch me, and if I fail to do your bidding see if something is not wrong with my harness or feet.

"Examine my teeth when I do not eat. I may have an ulcerated tooth, and that, you know, is very painful. Do not tie my head in an unnatural position, or take away my best defence against flies and mosquitoes by cutting off my tail.

"And finally, oh my master, when my useful strength is gone, do not turn me out to starve or sell me to some cruel owner to be worked and starved to death; but do thou, my master, end my life in the kindest way. You may not consider me irreverent if I ask this in the name of Him who was born in a stable. (Translated from the Arabic.)

A Dozen "Don'ts" for Horse Drivers.

Extract from the Annual Report of the Queensland Society for the Prevention of Cruelty:—

Don't fail to rug your horse when he stands in the cold.

Don't forget that ills often result from exposure and chill which follows suddenly checked sweating.

Don't fail to keep your horse well shod.

Don't work a lame horse or you may make a temporary injury a permanent one.

Don't let any alleged blacksmith lame your horse. Do you cut your own feet down to fit your boots? Well, don't forget that your horse's shoes should be shaped to fit his feet, and not his feet shaped to fit his shoes.

Don't load your horse too heavily, especially when the streets and roads are wet and slippery.

Don't force him to back a heavy load over a slippery road or up-hill.

Don't fail to grease your waggon axles. There is a heap of humanity in wagon grease.

Don't put badly-fitting harness on your horse.

Don't forget that there is more profit in coaxing a horse than in kicking him.

Don't thrash your horse if he jibs. Lift his collar and wipe it and his shoulder, and let the air at them; then tie your whip thong round his foreleg just below the knee and pull his leg forward to start him. Try it.

Don't illtreat your horse, or you may have to answer to the court for it.

A New Hen—The Cambar.

Queensland poultry raisers will be interested in this note on the evolution of new breed—the Cambar—by a writer in the "Spectator" (London), for 13th July, 1934. Few successes of greater interest or more prospect of practical value have been won in the field of agricultural biology than the making of the new Cambridge hen. Mr. Punnet and his fellow Mendelians at Cambridge have put into their new breed exactly the virtues they desired. and such precise control is comparable with the achievements of the plant breeders. The first Cambar, as the new breed was christened, was "invented" for the sake of possessing a pure-bred hen whose chicks would declare their sex at birth. It is, of course, an immense advantage to the industry to be able to distinguish day-old chicks, for the reason that they travel safely and well only during the first two days of their life; and the trade in day-old chicks becomes very large. This was the first success. Since then a silver as well as a gold Cambar has come into being; and by the use of the Canadian Barred Plymouth Rock (supplied by the University of British Columbia to Cambridge University) the new breed is becoming prolific and a great layer of large coloured eggs without letting go the virtue of "sex-linked" chicks. I saw six of them of one hatching last week; and the babes are as distinct in uniform as their parents. No one could fail to distinguish hen and cock. The birds mark an epoch in scientific breeding applied to practical purposes.

Queensland Co-operative Bacon Association.

At the annual meeting of the Queensland Co-operative Bacon Association, Ltd., Mr. James A. Heading, chairman of directors, presided, and, in moving the adoption of the report and balance-sheet, he said the operations had been conducted at a profit. The average price paid for pigs for the whole year was over one half-penny per lb. better than last year, and higher than since 1930. A total of 53,350 pigs had been received, an increase of 11,121. The numbers, however, were not nearly up to the requirements or capacity. The question of greatest moment at present was the need of greatly increased supplies.

Sales for the year were £178,576, an increase of £38,860. All branches of the selling organisation contributed to this increase. The quality of "Atlas" products had been consistently maintained, and this had been very helpful in increasing the demand.

The Sydney branch had another successful year, sales there being £51,071. The association now had 5,025 shareholders.

Negotiations for the amalgamation of the two co-operative bacon associations were still in progress, but it appeared most unlikely that they could be brought to fruition. In connection with the amalgamation proposals an independent valuation of the assets of the association had been made, and Messrs. Robinson and Jolly had certified that the assets were considerably in excess of book values. The election of directors resulted:—Burnett and Mary Valley, Mr. J. A. Heading (returned unopposed); West Moreton, Mr. G. Setch (returned unopposed); South Burnett and Brisbane Valley, Mr. G. E. J. Chaseling, 166; Mr. J. T. Mulcahy, 140. Mr. W. H. F. Buchanan was re-elected auditor. Chairman's allowance and the directors' and auditor's fees were fixed at the same as last year. Shareholders present expressed keen appreciation of the progress of the association.

Composition of Milk—Causes of Variation.

The average composition of pure cow's milk under New South Wales conditions is 86.88 per cent. water, 4.0 per cent. fat, 3.32 per cent. casein, .39 per cent. albumen, 4.67 per cent. milk sugar, and .74 per cent. ash, but variation may be caused by any of the following causes or any combination of them:—

1. The cow—its breed, its individuality, health, and condition.
2. The period of lactation.
3. Time of milking—morning or evening.
4. The part of the milk tested (whether first part or the strippings).
5. The food and water consumed by the cow.

Fat is a normal constituent of cow's milk, usually ranging on a percentage basis from 2.8 to 6.5 per cent., but varying (*a*) with the breed, and (*b*) with individuals of the same breed. The following table shows the range and the average of the butter-fat content of the milk of New South Wales cows of the different breeds:—

Breed.	Range.	Average.
	per cent.	per cent.
Australian Illawarra Shorthorn	2·8 to 5	4·0
Jersey, Guernsey	4·2 to 6·5	5·0
Ayrshire, Friesian	2·8 to 4·6	3·8

Several factors influence the variation in the fat content of milk given by the same cow. The more important of these are temperament, climate, physical condition, breed, and feed.

Temperament.—The cow is a very nervous animal, and harsh treatment easily upsets her. Often the better the breeding and the greater the production the more highly strung she is. Beating, scolding, and using dogs are some of the practices that should not be tolerated in a milking yard. Not only will the quantity of milk given decrease considerably from such treatment, but the fat content will likewise diminish. It has been noted frequently that a test has dropped 1 to 1.5 per cent., and the milk weight 30 to 50 per cent.

Climate.—Food given a cow serves the double purpose of providing (*a*) heat and nourishment of the body, and (*b*) milk. If the animal is well sheltered and rugged during very cold weather, a greater portion of the food eaten is used for milk production. Official records repeatedly show that during or immediately subsequent to cold, windy, wet weather the yields of cows not properly cared for in the way of shelter and warmth have been appreciably lowered.

Physical Condition.—Cows, like all other animals, have their periods of sickness, or they may be merely what we term "off colour." Digestion may be faulty or there may be some slight physical ailment, or something more serious, like abortion. The more frequent cause of variation in milk weight and fat content is from being in season. At such a time milk production is never normal.

Breeding.—The fat content of milk is to a great extent a question of inheritance. Different breeds are noted for high, medium, or lower percentage of fat. Jerseys, for instance, have long been noted for a high percentage. Friesians had in the past a name for great volume, but with a low fat content. Recently, however, this breed is proving by records that the average fat percentage has been and is being increased. The Australian Illawarra Shorthorns are proving the same thing. Thus it is evident that the capacity to give a milk rich in fat can be bred into any breed of cows by careful selection in a comparatively short period of time. This would not be done in one or two generations, but experience shows that a gradual improvement can be made.

Feeding.—A cow inherits fat-producing capacity (*a*) on account of her breed, and (*b*) individually, as a result of breeding. This might be termed her maximum capacity. She can, by careful treatment and proper feeding, and if everything is in her favour, reach this maximum, but not exceed it. Even to reach it too great a strain might be necessary on her constitution for too long a time, to her permanent injury.

The first essential to giving a cow a chance to show what she can do in the way of production is to have had her sire in good health and condition when serving her dam, and more important still is that the dam should have been in good condition at time of calving. The heifer when born needs the best of attention as regards feeding and housing during the first six months of her life, especially during the first two. If a cow has been well born and well reared her records for production in after life depend to a great extent on feeding.

She should not be starved during the three or four months preceding freshening, and after calving she should be well and regularly fed. Both under-feeding and over-feeding are undesirable; too rich a ration (one containing too great a proportion of concentrates) and a ration of grainless wheat straw are both to be avoided. The digestive organs of a cow should not be out of order if she is to give good results. The cow's test will vary according to her feeding, but is limited by her inherited maximum.

During droughts, when stock are nore than half-starved, the fat content of their milk is lowered. This has been demonstrated by the official records obtained from both Government and private herds. Again, during the spring season, when the pastures are soft and young, while the quantity of milk given increases, the fat percentage is lowered.—A. and P. Notes, N.S.W. Dept. Agric.

Buying Better Boars—Assistance to Settlers.

The Better Boar Subsidy Refund Scheme in operation over the period August, 1933, to 30th July, 1934, attracted considerable attention throughout Queensland and resulted in a wide distribution of pedigreed boars in the Large and Middle White breeds, and in increased interest in the development of more extensive outlets for Queensland pork in the markets of the United Kingdom.

Boars were distributed to numerous centres in the Western, far Northern, and Central areas; to the South, Central, and Upper Burnett; North and South Coast and branch lines. This scheme terminated on 30th June, 1934, and has been replaced by a scheme fostered by the Rural Assistance Board of the Agricultural Bank. Under this scheme the Board, acting in co-operation with the Agricultural Bank and Department of Agriculture and Stock, advances on loan 50 per cent. of the landed cost of boars, four months to two years of age, in the following breeds:—Large White, Middle White, Tamworth, and Berkshire.

Forms of application are now available and may be obtained by writing to the Department of Agriculture and Stock, Brisbane, or to the Agricultural Bank. The loan is repayable on easy terms over a period of two years, subject to satisfactory arrangements being completed on receipt of the application form properly completed and accompanied by a fee of 5s. payable to the Rural Assistance Board, Agricultural Bank, Brisbane.

Points for the Pig Raiser.

A question that often crops up in the judging of pork and bacon pigs at agricultural shows is as to whether the sow will make up into better bacon than the barrow. The answer to such a question takes into consideration two phases. Sow pigs, particularly in warm climates, come in season very early and one often notices sows awaiting slaughter that show distinct evidence of the oestral period (or of being on heat or in season). If slaughtered while in the feverish condition that accompanies the oestral period the meat will not set well nor will it be as mellow as is desirable in the finished form.

On the other hand sow pigs produce a larger proportion of first grade lean meat than barrows, for sows are lighter in back fat and are thicker in the streak of lean meat running along the sides than is the case with males; on the other hand there is less risk with barrow pigs, although it must be remembered that improper castration often results in the formation of deep-seated abscesses in the area of the scrotal sac and many a good pen of barrow baconers has suffered at the hands of the judge who is discriminating and takes a special care to examine that portion of the body before giving his decision. Perhaps after all, sow pigs do make the best bacon, but on the average so much depends on breeding, type, feeding, and handling that the matter of sex is virtually an unimportant one, and further the farmer has no control over the sex of his pigs, so must make the best use possible of both boars and sows.

Is Salt a Tonic or an Appetiser.—Visiting a well-known Brisbane stud piggery recently, it was noticed that the man in charge of the pigs kept a bag of coarse salt (usually known as pickling salt) close to the feed boiler. When asked if he used salt in the food he replied that he regularly added a handful of salt to the food when preparing same for cooking, for he had noted over a series of years that the pigs always made better growth and had better appetites when a little salt was added to their food.

The quantities used would, of course, be important, and should not exceed, say, one half teaspoonful per pig per day; salt has a good food value, and is a necessity in all rations, but care must be taken not to force the pigs to consume too much, and the water in which corned beef or ham has been boiled should on no account be used unless distributed over a large quantity of food, for salt can become a poison just as it is a necessity. Charcoal, wood ashes, and bone meal are further additions, so also is a cup full of lime water added to the pig's food occasionally.

The careful farmer watches all these points and sees to it that his pigs do not suffer as a result of a deficiency in mineral matters.—E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

Controlled Grazing of Pastures.

Conditions vary so much in different districts, and even on the same property, that no hard-and-fast rules can be laid down with regard to the subdivision of paddocks, observes a departmental pamphlet on pasture management. The aim should be to provide sufficient paddocks to control the grazing completely, so that an even growth can be maintained in each. With controlled stocking the pastures can be fed off when at their maximum feeding value, i.e., when they are providing short, succulent growth high in protein content, and there is no waste such as is associated with more mature but less palatable and less nutritious growth.

Paddocks that are too large result in stock having to travel long distances for food and water, which is particularly undesirable for fattening or milking stock, as much of the food consumed is then used to supply energy for unnecessary walking. This point is of importance to those contemplating fat-lamb raising or the production of early-maturing beef. Large paddocks are also responsible for a certain amount of erosion, as the animals in their search for food tend to traverse definite tracks, which become bare of grasses. In hilly country these bare tracks form channels along which water flows, finally resulting in erosion.

The expenditure entailed in laying down large areas of sown pastures on well-prepared land is considerable, and although returns amply justify the outlay, some pastoralists have not the capital available for this work on a large scale. By choosing the most suitable soils and situations, however, it is remarkable what excellent results can be obtained from small areas of sown pastures when used in conjunction with larger areas of natural pastures, and graziers with limited capital should proceed on these lines.

Creek-frontage country properly subdivided, with the land well prepared and sown down to mixtures of grasses and clovers or lucerne, is particularly suitable for this purpose. These areas should be subdivided and fenced so that stocking can be regulated and the stock given access both to the sown and natural pastures; it should always be possible to close up the sown pasture when necessary. It may be thought that where stock have ready access to sown pastures they will concentrate on these and neglect the natural pastures. In practice, however, this is seldom the case, as a certain amount of rough feed is essential and the stock will obtain this from the natural grasses.

By adopting this system stock can be left in the paddocks for longer periods than would be the case with small paddocks of sown pastures, and then can be kept off the sown pastures in the event of over-grazing on these areas. It may also be desirable to save the sown pasture at times in order to ensure a supply of winter feed or succulent pasture for lambing ewes, sick animals, or for "topping off." When working on these lines, the movements of stock can be regulated to some extent by top-dressing. It is not sound practice, for example, to top-dress the small area of improved pasture and leave the natural pasture unmanured, as this tends to encourage grazing on the improved section. By top-dressing the natural pasture, the palatability and nutritive value are increased and the tendency is for the stock to utilise these pastures in conjunction with the sown pasture.

A system similar to the above is also desirable with grazing lucerne, as a balanced ration is provided, and the stock can be quickly moved on to the grass in the event of hoven, although liability to this trouble is decreased by the practice.

When arranging the disposition of watering-places, stock licks, &c., consideration should be paid to the well-being of the pastures, and these so placed as to avoid concentration of grazing on small patches as far as possible.

Top-dressing, particularly on herbage country, frequently results in a pasture composed almost entirely of clovers for a period, and where this occurs stock should have access to grass paddocks where the percentage of clover is small.—A. and P. Notes, N.S.W. Dept. of Agri.

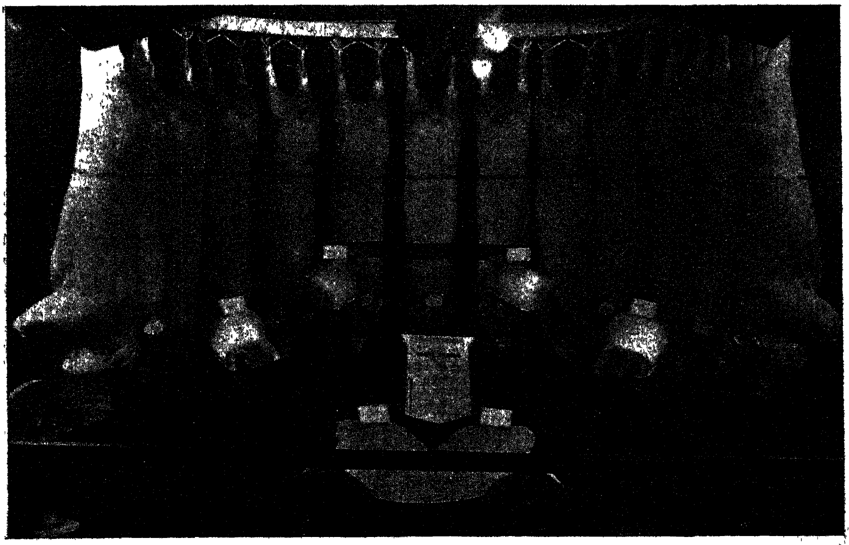
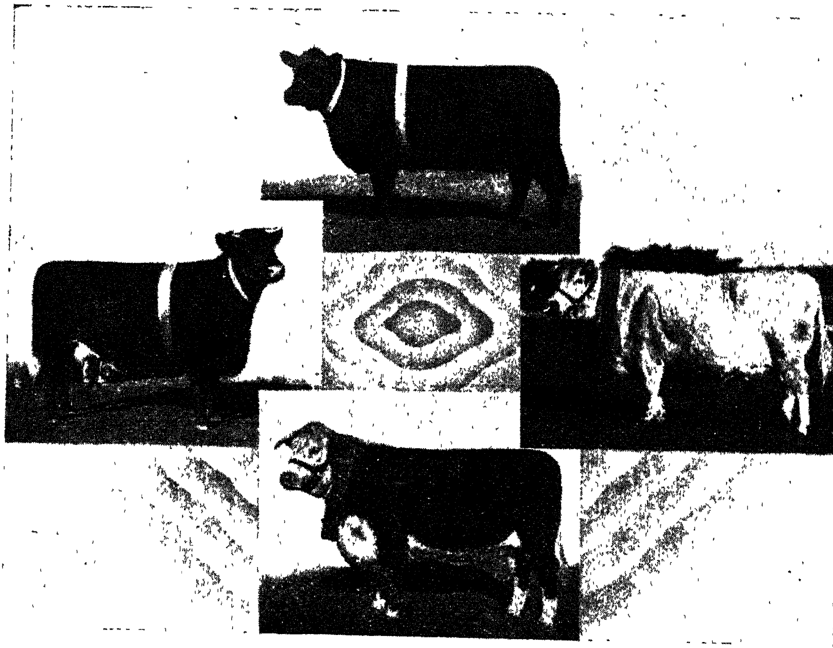


PLATE 281.—TYPES OF SOUTHERN QUEENSLAND PORKERS.

[Block by courtesy of the Queensland Meat Industry Board.



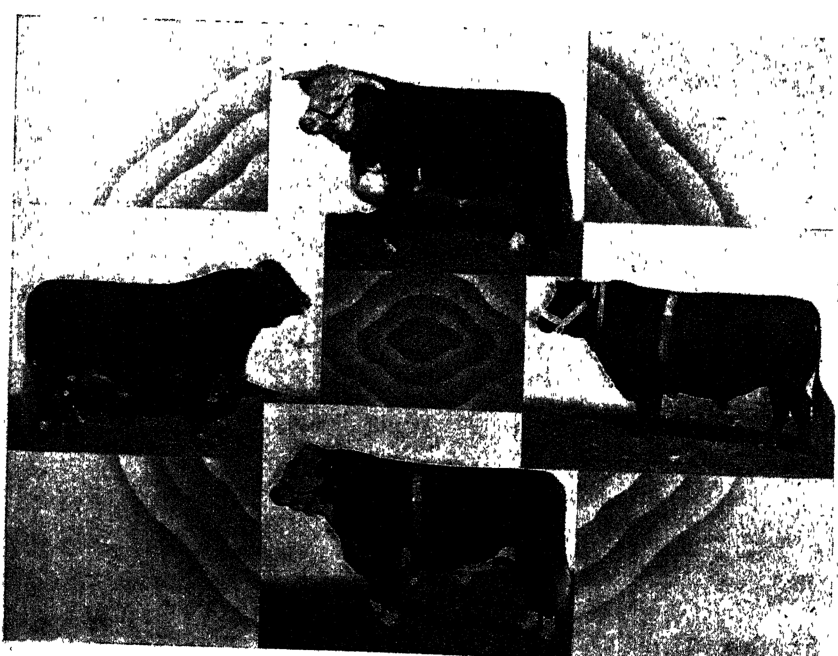


PLATE 282.—BEEF CHAMPIONS, BRISBANE SHOW, 1934.

[*Block by courtesy of the Queensland Meat Industry Board.*

Well and Sub-Artesian Bore Sites

The services of the Government Water Finder (Mr. J. H. Bestmann) are available to settlers in Queensland for the purpose of locating well or sub-artesian bore sites.

A fee of 10s. is charged for each site selected, together with a mileage rate of 1s. a mile (one way) from the nearest railway station to the site.

Applications should be addressed to the Secretary, Land Administration Board (Public Estate Improvement Section), Department of Public Lands, Brisbane.

Note.—The Water Finder will be sent to distant localities only if there are a sufficient number of applications from such localities to warrant the necessary expenditure.

Tobacco Seed for Sale

Seed of the following varieties of tobacco seed is procurable from the Department of Agriculture and Stock, Brisbane, at the rate of 4s. per oz., postage paid, cash with order:—

Hickory Pryor, Yellow Pryor, Cash, Warne, and Gold Leaf.

Applications for seed should be addressed to the Under Secretary, Department of Agriculture and Stock, Brisbane.

All seed has been secured from plants grown in disease and mould free areas, and, after grading, treated with silver nitrate solution.

No necessity exists for further treatment of the seed.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

ECONOMICAL DIETS.

In November, 1933, there was published a valuable report of a special committee appointed by the Council of the British Medical Association "to determine the minimum weekly expenditure on foodstuffs, which must be incurred by families of various size, if health and working capacity are to be maintained, and to construct specimen diets." Food prices in Queensland are very different from those in Great Britain, and it would be impossible for us to accept the diets proposed without modification; but by adopting the data given in this report, and by following the same methods of calculation, it is possible to construct sample diets, which should be useful to those Queensland mothers who are compelled to exercise great economy, and should enable them to spend their small weekly allowance in such a way that the nutrition of their families should not suffer.

Requirements of the Diet.

It is obvious that a man weighing 9 stone engaged in a sedentary occupation can maintain his health and working capacity on less food than is necessary for a man weighing 13 stone, who is doing daily hard muscular work. We are compelled to strike an average, and allowance will have to be made for individuals who depart largely from that average. The diets given are calculated for an average man not engaged in strenuous manual labour. It must provide sufficient food to maintain health and weight, and food of suitable kind. That is, it must be of adequate energy value, must contain an adequate quantity of proteins (body-building foods), carbo-hydrates (starches and sugars), and fats. It must also contain a liberal supply of vitamins, a most important point, in which many common diets fail lamentably. Finally, it must provide sufficient variety, so that there is no deadly monotony in the diet.

Methods of Calculation.

The energy value of a diet is calculated in units which are called calories. The official scale in Great Britain has been 3,000 calories per man daily. For several good reasons the committee has adopted a higher scale of 3,400 calories. The requirements in proteins are placed at a weight of 100 grams, of which one-half should be animal proteins. Those of fats also at about 100 grams, of carbo-hydrates 500 grams. The contents of proteins, fats, and carbo-hydrates in all common foods have been ascertained by analysis; the vitamins cannot be determined quantitatively, but in the diets constructed they are abundantly present.

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Sample Weekly Diets.

—	Man, wife, one child between 3 and 6.		Man, wife, three children; one between 6 and 8, one between 8 and 12, one between 12 and 14.	
	Quantity.	Price.	Quantity,	Price.
		s. d.		s. d.
Beef and mutton (cheaper cuts)	4½ lb.	1 1½	10 lb.	2 6
Liver, heart, kidneys, &c.	2 lb.	0 6	3 lb.	0 9
Eggs	..	..	4	0 4
Cheese	½ lb.	0 6	½ lb.	0 6
Milk	10½ pints	2 7½	14 pints	3 6
Butter	1 lb.	1 4	1½ lb.	2 0
Dripping	1 lb.	0 4	1½ lb.	0 6
Flour	4 lb.	0 6	6 lb.	0 9
Cooking Bran	..	¼	..	0 0½
Bread	13½ lb.	3 4½	27 lb.	6 9
Sugar	3 lb.	1 0	5 lb.	1 8
Golden Syrup	..	..	1 lb.	0 3½
Jam	1 lb.	0 4	1 lb.	0 4
Potatoes	8 lb.	0 9	14½ lb.	1 4
Dried peas or beans	½ lb.	0 2	1 lb.	0 4
Oatmeal	1 lb.	0 3	2 lb.	0 6
Wheatmeal	1 lb.	0 3	2 lb.	0 6
Rice	½ lb.	0 1½	..	..
Pearl Barley	..	..	½ lb.	0 1½
Tea	½ lb.	1 0½	½ lb.	1 0½
Salt, carbonate soda and cream of tartar ..	..	0 1½	..	0 2½
Fresh fruit and vegetables	..	2 0	..	3 0
Total	..	16 4¼	..	29 11¼

Man Values.

If the food requirements of a man be taken as one, that of other members of the family are calculated on the following scale:—

Ages.	Man-value.
Adult, man	1.00
Adult, woman	0.83
Child, 1 to 2 years	0.30
„ 2 to 3 years	0.40
„ 3 to 6 years	0.50
„ 6 to 8 years	0.60
„ 8 to 10 years	0.70
„ 10 to 12 years	0.80
„ 12 to 14 years	0.90
Persons over 65 years	0.75

To calculate diets for families of all sizes and ages is therefore possible. We shall content ourselves with two families only.

The first consists of man, wife, and one child between three and six years of age. By reference to the following table its man-value is found to be 2·35. The second family consists of man, wife, and three children, one between six and eight years, one between ten and twelve, one between twelve and fourteen. Its man-value is 4·13. We shall omit the calculations of the calories, proteins, carbo-hydrates, and fats of each article in the two diets, and merely give the totals.

In the first diet the calories are 3,454, the proteins 100·5 grams, of which 47·1 are animal proteins, the fats 106·1, the carbo-hydrates 493·0 per man per day. In the second diet the calories are 34·9, proteins 103·2, animal proteins 47·2, fats 108·4, carbo-hydrates 498·2. These calculations are not so precise as they seem, as some foods vary in composition. They are given to satisfy those who understand these matters. For most of our readers only the quantities and prices are of importance.

Remarks.

These diets are sufficiently varied and contain everything necessary for wholesome nutrition. Undoubtedly they might be made more varied and pleasing by spending a few more shillings, but as they stand they are better food than is consumed by many who spend twice as much. There is a prejudice against liver, but it is a more valuable food than beef-steak, and many like it disguised under the name "lamb's fry." One pint of milk per day is provided for the child under six, half a pint for the older children, one quarter pint for the adults. It would be better to have two or three pounds of butter, but for economy dripping has been substituted for half the butter, not margarine, which costs three times as much and is not a trustworthy food. Cooking bran is provided to supply a necessary vitamin, and its cost is negligible. Eggs should be bought only when cheap; when they are dear another half pound of cheese may be substituted. A fixed sum is provided for the purchase of fresh fruit and vegetables, to be expended at the discretion of the housewife. She is specially advised to buy tomatoes when they are cheap. Tea has no food value, but has become a necessity to many adults. Children do not need it and are better without it. At most they should have a mere pretence.

The prices are low (not always the lowest) Brisbane prices, but the prices of many things vary. We cannot give the prices elsewhere; our readers must find out for themselves.

IN THE FARM KITCHEN.

THE DIETETIC VALUE OF THE POTATO.

Subjoined are extracts from the address of Mr. A. J. PINN, Special Agricultural Instructor, at a recent New South Wales Agricultural Bureau Conference:—

The potato has always been regarded as an important vegetable in the diet of Australians. Its use in the diet has, in the past, not been dictated by any study of the dietetic value, but simply on account of its appeal to the palate, its relative cheapness as an article of food, its ease of preparation, or by habit acquired in the early home-training.

Owing to the fact that the *per capita* consumption of potatoes is decreasing, and in the light of recent dietetic investigations, it is necessary from a community health point of view that the general public be acquainted with facts relative to the health-giving tuber. With so many "Eat More" campaigns, and the advertised claims of various manufactured foods, it is also necessary that the consumer give serious consideration, not to bold statements made in advertisements, but to the true facts founded on scientific investigations. It is quite obvious that most persons cannot eat more of all the various foods advertised, so must therefore choose those which are at a cost within the limits of the purse, and at the same time provide the necessary requirements for the sustenance and healthy functioning of the body.

In order to obtain the full food value of the potato, it is essential that the housewife should know that the methods of cooking now commonly practised are wasteful. In the first place it must be realised that in the peeling of tubers much

of the nutrient value of the potato is lost, and for that reason it is suggested that the cooking in the skin should become more general. Baking the tubers is less wasteful of food values than boiling.

If it is desired to follow the old practice of first peeling the potatoes before boiling, it is desirable that the potatoes be not soaked in water, awaiting time to commence cooking. This practice allows of loss of food value, as also does the placing of the potatoes in cold water to bring them to the boil. If the peeled tubers are placed direct into boiling water, much less loss of food value results. Research by the Chemical Division of the Minnesota Agricultural Experiment Station has indicated that the loss of albumenous compounds was as follows:—

	Percentage loss.
(*a*) Peeled potatoes started in cold water	80
(*b*) Peeled potatoes started in hot water	10
(*c*) Potatoes, *not* peeled, started in cold water	50
(*d*) Potatoes, *not* peeled, started in hot water	2

The following extracts from the writings of Dr. J. H. Kellogg, Superintendent of the Battle Creek Sanatarium, Michigan, U.S.A., should be of interest, particularly in respect to the value of the potato as a health food.

The potato is truly a most remarkable product. It contains within its aseptic covering a rich store of one of the most easily digestible of all forms of starch. The observations of Mosse, Van Noorden and others have shown most conclusively that the starch of the potato is more easily digested and appropriated by the body than the starches of wheat, corn, and most other cereals. In laboratory tests made by the writer it was found that potato starch digested in less than one-sixth of the time of cereal starches.

"The potato is not only an easily digestible foodstuff but possesses much higher nutritive value than is generally supposed. According to Gautier, about one-fourth of the weight of the potato is food substance, consisting chiefly (nine-elevenths) of starch. Of the remainder, three-fifths are protein (the tissue-building element), and two-fifths alkaline salts in combination with citric and malic acids (acids of the lemon and the apple).

"The belief is quite general that the potato especially promotes fat-making, and hence that its use must be avoided by persons who have a tendency to obesity. This is also an error. All foods tend to produce obesity when taken in excessive quantity—that is, more than the individual needs to maintain his nutrition on equilibrium. No foods produce excess of fat when limited in quantity to actual daily bodily needs.

"As a matter of fact, the potato is deficient in fats, of which it contains almost none, because of the fact that it is not, like so many of our vegetable foods, a seed, but a curiously modified and enormously fleshy tuber. This deficiency in fat must always be remembered in the use of the potato, and the lack must be made up by the addition of cream, butter, or some other foodstuff rich in fat.

"The potato is of immense service as a food remedy in the treatment of a large number of diseases. It is especially valuable in cases of chronic intestinal auto-intoxication or 'biliousness.' It affords bulk for the intestine to act upon, and so antagonises constipation. The large proportion of starch and other carbohydrates encourages the growth of friendly bacteria in the intestine, thus preventing putrefaction. For the same reason the free use of potatoes combats rheumatism and gout, which are results of chronic intestinal poisoning.

"The potato is valuable in the treatment of anæmia, because it contains the growth in the intestine of the germs which produce blood-destroying poisons. The death rate from diabetes, according to the mortality statistics of the United States Census Bureau, has increased nearly 50 per cent. in ten years. The freer use of potatoes as an article of diet and the lessened consumption of meat would perhaps do more than any other one thing to suppress the alarming increase of this fatal malady.

"Arteriosclerosis, or hardening of the arteries, a disease which causes apoplexy, and is associated with Bright's disease and various forms of heart diseases, besides being the cause of premature old age, is most often directly the result of chronic poisoning, the source of which is the putrefaction of undigested remnants of animal substances which have been eaten, which undergo decay with the absorption of poisonous products. The free use of the potato as an article of diet in place of the excessive consumption of meat and fish, a practice widely prevalent, would unquestionably check the alarming rapid development of this disease, which, according

to the United States mortality reports, has increased 400 per cent. in the last ten years.

"The potato, butter-milk, and oatmeal diet of the Irish has developed one of the most sturdy and enduring races of men to be found anywhere. The proportion of centenarians in Ireland is more than ten times as great as in England. There can be no doubt that the free use of potatoes by the Irish is in a large measure responsible for the remarkable longevity of this nation.

"The potato more than any other single article of food is capable of rendering a notable service in conserving and prolonging human life. It is highly important that the public should be informed respecting the supreme dietetic value of the potato and instructed in its use. Every adult should eat at least 1 lb. of potatoes daily. It is to be remembered that the tuber is three-fourths water. Infants of six months may be given potato puree with benefit, especially as a protection against acidosis, which often manifests itself in children as cyclic vomiting.

"More potatoes and more milk, more green vegetables—spinach, lettuce and the like—with bran and fresh fruits to aid elimination; these are the nation's greatest dietetic needs."

RECIPES.

Baked Apple Dumplings.

Materials.—Four apples, 4 cloves, 4 teaspoonfuls sugar, 1 dessertspoonful butter, icing sugar, ¼ cup of water. For Pastry—4 oz. flour, 2 oz. lard or dripping, ¼ teaspoonful baking powder, pinch of salt, ¼ cup of water.

Utensils.—Knife, corer, board, baking tin, brush.

Method.—

1. Peel and remove cores from apples.
2. Put into centre of each apple, sugar, clove, and butter.
3. Make short pastry, cut it into four parts, knead each part into a circle.
4. Put an apple on each circle; work the circle up to cover the apple.
5. Put covered apples on a baking tin; brush over with sugar and water.
6. Bake in a moderate oven for 30 minutes or until apples are tender.
7. Sprinkle with icing sugar; serve with custard.

Chocolate Pudding.

Materials.—One cup bread crumbs, 1 egg, 1 cup milk; 1 dessertspoonful butter, 1 tablespoonful chopped nuts, 1 tablespoonful sugar, 1 dessertspoonful of cocoa.

Utensils.—Pie dish, whisk, spoon, saucepan, basin, cup.

Method.—

1. Attend to the oven.
2. Place milk on to boil; put bread into a basin.
3. Pour milk over bread and allow to stand covered for ten minutes.
4. Add cocoa or chocolate, sugar, nuts, butter, and beaten yolks of eggs.
5. Beat all well together.
6. Place in a greased pie dish and bake in moderate oven for three-quarters of an hour.
7. Decorate with well-beaten white of egg.
8. Return to oven and slightly brown.
9. If steamed, add the well-beaten white of eggs, fold in lightly, and place in greased basin and steam for one and a-quarter hours.
10. Serve with boiled custard or chocolate sauce.

Chocolate Sauce.

Materials.—One dessertspoonful arrowroot, 1 dessertspoonful cocoa, 1 tablespoonful sugar, 1½ cups boiling water.

Utensils.—Wooden spoon, basin.

Method.—

1. Blend arrowroot, sugar, and chocolate together in a basin.
2. Pour over sufficient boiling water to form a thick syrup.

Cup Pudding.

Materials.—One cup finely chopped suet, 1 cup sugar, 1 cup flour, 1 cup white bread crumbs, 1 cup mixed dried fruit, 1 teaspoonful spice, 1 teaspoonful carbonate of soda, 2 cooking apples, 1 egg or ¼ cup milk, ½ cup water, 1 tablespoonful of caramel (browned sugar and water).

Utensils.—Knife, bowl, wooden spoon, basin, pudding cloth or greased paper, saucepan or steamer.

Method.—

1. Peel and cut apples up finely; prepare dried fruit.
2. Put flour, sugar, breadcrumbs, dried fruit, spice, soda, apples, and chopped suet into a bowl.
3. Add egg or milk, water and caramel; mix well.
4. Put mixture into a greased basin; cover with pudding cloth, tied down securely or with greased paper.
5. Boil for three hours or steam for four hours.
6. Turn out; serve hot with sweet white sauce or custard.

French Apple Tart.

Materials for Pastry.—Six oz. flour, 3 oz. lard, 2 tablespoonfuls sugar, yolk of 1 egg, ¼ cup milk, 1 teaspoonful cinnamon.

Utensils.—Bowl, cup, whisk, rolling-pin, knife, tin plate.

Method.—

1. Rub lard, sugar, and salt into flour.
2. Mix with beaten yolk of egg and milk.
3. Turn out on floured board; knead; cut in half; roll out one part.
4. Cover a tin plate with this part; add apple mixture.
5. Roll out other part; cover the fruit; make a hole in centre; brush over; decorate.
6. Bake in a moderate oven thirty to forty minutes.
7. Sprinkle with sugar and cinnamon.

Apple Mixture.

Materials.—One lb. apples, ½ lemon, 2 tablespoonfuls sugar, 1 teaspoonful butter, 1 tablespoonful each of sultanas and currants, ¼ teaspoonful of spice, nutmeg, and cinnamon, 1 teaspoonful of sliced peel.

Utensils.—Saucepan, knife, wooden spoon, teaspoon, lemon squeezer, lemon grater.

Method.—

1. Put peeled and quartered apples into saucepan.
2. Add sugar, lemon juice and rind, butter, sultanas, currants, candied peel, nutmeg, spice, and cinnamon. Stew till apples are soft; stirring continuously.

Fruit Salad.

Method.—

1. If pineapple is used the stalk end should be cut off and the pulp separated from the core with a fork.
2. Fruit such as apples, pears, peaches, must be peeled, cores or seeds removed, and pulp cut up into small pieces; steel knives should not be used.
3. The pulp of passion fruit or granadillas must be scooped out of the shells.
4. Bananas should be cut into rings crossways, or thin slices lengthways; they must not be added to the other fruit until shortly before the salad is served.
5. When all other fruits are prepared they should be well mixed in a basin; the juice of half a lemon and sugar to taste should be added.
6. Fruit salad may be served in a large china or glass bowl or in small glass dishes with custard or cream; icing sugar is sometimes added.

Lemon Cheese.

Materials.—Two eggs, 2 oz. butter, 2 oz. sugar, juice of a lemon.

Utensils.—Saucepan, wooden spoon.

Method.—

1. Put yolks of eggs, sugar, lemon juice and butter into a saucepan.
2. Stir over fire till thick and smooth.

Jam Roly Poly.

Materials.—Eight oz. flour, 4 oz. suet, salt, ¾ teaspoonful baking-powder, ¼ cup water, jam or treacle.

Utensils.—Knife, sieve, bowl, board, rolling-pin, pudding cloth, string, pins, saucepan.

Method.—

1. Skin and chop up suet finely.
2. Sift flour, baking-powder, and salt into a bowl.
3. Rub suet into the flour with the tips of the fingers.
4. Add water slowly; mix into a dry dough.
5. Turn out on floured board; knead.
6. Roll out into an oblong shape about ¼ in. thick; spread with jam to about ½ an inch from the edges.
7. Roll up; press down outer edge and push ends in closely; place in the middle of a pudding cloth dipped in boiling water and sprinkled with flour.
8. Fold cloth round pudding; tie ends firmly with string; pin the cloth together at the middle.
9. Put into a saucepan of boiling water; boil for one and a-half to two hours; serve hot with white sauce.

Lemon Arrowroot Pudding.

Materials.—Half a cup sugar, 1 lemon, 2 tablespoonfuls arrowroot, 2 eggs, 1 dessertspoonful butter, 1 pint boiling water.

Utensils.—Bowl, wooden spoon, cup, knife, grater, whisk, pie dish, tablespoon.

Method.—

1. Blend arrowroot with a little cold water.
2. Add yolks of eggs well beaten, sugar, lemon juice, grated rind, and boiling water.
3. Mix butter well through; pour into a buttered pie dish.
4. When cold put the whites of eggs, stiffly beaten, with two tablespoonfuls sugar on top.
5. Put in a moderate oven until meringue is crisp and of a pale golden colour.

Lemon Sago, or Pineapple Sago.

Materials.—Half a cup sago, 2 lemons, 1 tablespoonful sugar, 2 tablespoonfuls golden syrup, 1 pint water—½ pint for soaking and ½ pint for cooking.

Utensils.—Saucepan, knife, squeezer, mould.

Method.—

1. Wash sago; soak two hours.
2. Wipe lemon; grate rind and squeeze juice into a basin.
3. Put water on to boil in a saucepan.
4. Add sago; cook till transparent, stirring occasionally.
5. Remove from fire; add lemon rind, juice, sugar, and syrup.
6. Pour into a mould; serve cold.

Notes.—

1. If lemons are not procurable a crystal of citric acid may be used.
2. Grated pineapple may be used instead of lemon.

Wholemeal Nut Loaf.

Ingredients.—Two cups wholemeal flour (finely ground), 1 teaspoon cream of tartar, ½ teaspoon carbonate of soda, 1½ tablespoons butter, 1 tablespoon sugar, ½ cup nuts, ¼ cup raisins, ¼ cup sultanas, 1 tablespoon golden syrup 1 egg, 1 good cup milk.

Method.—Mix flour, sugar, cream of tartar and soda, and rub in butter; add nuts and fruit. Dissolve golden syrup in milk and add to well-beaten egg. Mix all together, put into greased tins with lids on, and bake about three-quarters of an hour in a moderate oven.

A raisin loaf without nuts can be made if desired.

Wheatmeal Fruit Cake.

Ingredients.—Half pound butter, ½ lb. sugar, 1 lb. fine wheatmeal, 6 eggs, 1 teaspoon cream of tartar, ½ teaspoon carbonate of soda, ¼ lb. chopped dates, 2 oz. nuts, ¼ lb. raisins, ¼ lb. currants, 1 oz. mixed peel.

Method.—Beat butter and sugar to a cream. Add eggs, one at a time, and beat for ten minutes. Add fruit, nuts and peel, and wheatmeal, cream of tartar, carbonate of soda, and a little milk if necessary. Put into greased tin and bake for one and a-half to two hours.

Wheat "Coffee."

Ingredients.—Three large cups of wheat, 2 tablespoons treacle, 1 tablespoon golden syrup, 3 teaspoons salt.

Method.—Wash wheat; drain and put into shallow baking dish, sprinkle salt on and mix in treacle and golden syrup, covering well all the wheat. Put into a hot oven and cook for one hour to one and a-half hours, stirring to prevent burning. When well cooked and the colour of the coffee bean when well roasted, remove from oven and allow to cool. Grind through wheat mill and store in sealed tins to keep in the strength.

Use one dessertspoonful of wheat "coffee" powder to each person, and add the hot milk to the coffee when ready to serve.

Summer Fruit Drinks.

Nothing is more refreshing or pleasing in warm weather than a well-prepared fruit drink, while from a health point of view the habit of drinking fruit juices needs no stressing. Their wholesomeness may be particularly emphasised as beverages for children, who, left to their own devices, are quick to acquire the taste for them. Many so-called orange and lemon drinks contain no fresh fruit at all, but are made from chemicals and artificial colouring matter. Not only do they not have the food value that the real fruit possesses, but they may be definitely injurious to the child's health.

The only drinks of this kind that the child should be permitted to have should be made from the fresh fruit juice. Mothers who make real fruit juice drinks for their children will not be teased for artificial soda and other harmful drinks. Fruit juices not only satisfy thirst; the natural fruit acids they contain supply beneficial elements to the child's diet.

Pineapple Drink.—Wash the skin of pineapple. Place in a lined saucepan with the core and enough cold water to cover. Cook slowly three-quarters of an hour. Add 3 tablespoons or more sugar and the juice of 1 orange or lemon. Strain and allow to cool. Chill and serve.

Fruit Punch.—Take ½ cup lemon juice, 1 cup orange juice, grated rind ½ orange, 1 tablespoon grated lemon rind, 1 quart water, 3 or 4 cups of sugar. Cook water and sugar for 3 minutes, cool and mix with orange and lemon juice, rind, &c. To this add the following ingredients:—(1) 1 quart ginger ale, ¼ cup preserved ginger cut up finely, (2) 1 cup grated pineapple, 1 pint soda water.

Fruit Cup.—Take 2 lemons, 1 quart boiling water, 2 oranges, 4 passion-fruit, 1 ripe pear (if available), 4 tablespoons sugar, few drops cochineal. Wash lemons, peel thinly into a large jug or bowl; squeeze juice and place it in jug with rind and sugar; pour the boiling water over this and cover till cold. Strain into glass jug, colour very pale pink, add slices of oranges, passion-fruit pulp and cut pear or other fruit. Place in ice chest and serve very cold.

WHAT WE OWE TO TREE PLANTERS.

"Redgum," writing in the "Sydney Morning Herald," has this to say on our debt to the people who plant trees:—

Every man and woman interested in the planting of trees for economic purposes or for beautification has reason to be pleased with the planting work that has been done during the season now drawing to a close.

Not for many years has so much attention been paid to the planting of ornamental trees on the roadways of the State (New South Wales). In parklands, also, splendid work has been done.

At Parkes, Albury, Peak Hill, Armidale, Tamworth, Orange, Blayney, Bathurst, Nowra, Lithgow, Blackheath, Springwood, Penrith, Faulconbridge, West Maitland, Grafton, Blaxland, Crookwell, Manly, Collaroy, Katoomba, and Glenbrook additions have been made, or are to be made, to the arboreal beauty of the towns because the men who are working to bring their home areas into line with the new tree thought of the day, have realised that the only effective way of adding permanent and abiding beauty to Brewarrina, Bourke, Ballarat, or Branxton is to utilise the living loveliness of the trees that seem to find pleasure in the work which their worst enemy, man, now and again gives them to do.

These men are doing something that will one day make their towns more healthy, more beautiful, and more enjoyable. They are but following in the footsteps of the wise men of the yesterdays, who knew the value of trees.

Time and again it has been definitely stated that a town without trees is the town that is the easiest to forget.

It is the beauty of the open road, the parklands, and the town highways that wins favour to-day. Grafton is the best known town in the State, because of her jacarandas; Bathurst's Machattie Park endears her to thousands of travellers and tree lovers; Cook Park makes Orange memorable; a line of shapely poplars keeps Richmond from being forgotten; stately Lombardy poplars tell of Tumut's worth; Belmore Park, Goulburn's pride, is a jewel in jade; Lithgow's acalyphas are hard to forget; Fig Tree's giant scrub fig and its flame tree companion are the two best-known trees between Sydney and Kiama; Blackheath's scarlet oaks are unforgettable; Woollahra's Oriental plane trees add grace and dignity to the roadsides; Parramatta's old English oaks are joyous trees in the spring; and Wahroonga's grey-limbed planes tell their own sweet story to all who have time to interpret it from the signs in the limbs and the leaves.

I was almost forgetting the appeal that the Norfolk Island pines, growing on the ocean beach at Manly, make to the men and women who enjoy the strength and symmetry of such glorious wind and sea loving trees. No wonder that Manly stands alone. The Norfolk Island pine made her famous long before our boys and girls were permitted to tumble into the surf.

A LIVING ART.

The tree is the dominating factor in town and country landscape to-day. No town planning ever will be effective without arboreal embellishments. Tree planting is an art, building stores and Spanish bungalows is all science and solidity. Living decorations laugh at those we make of plaster and paint. If I read the signs on the roadsides aright—I have as good a chance of knowing what is happening in the world where trees and gardens count for something as the next man—to-day's tree planting movement is gaining its momentum because the glory and the beauty of our trees is creeping into the very souls of our men and women, and working, as beauty, love, and loyalty ever will do, a new regeneration in their lives. Love is irresistible. Form and colour are adorable. Spring's gaity and charm are enchanting. Sunlight and shadow are as indispensable as day and night, growing greenness and opening rosebuds are among the most poetic movements in life. Is it any wonder that our men and women are opening their homes and their hearts to the trees?

What really began this great latter-day regeneration, and so stirred the heart of the nation?

Canberra! Colourful, beautiful Canberra! The artist who did the tree planning and tree planting at Canberra opened up new highways into new tree lands that were never dreamed of before. He found the favoured area a wind-swept, brown-bodied sheep run, and left it a great national parkland, made superbly beautiful with trees.

Canberra increases in beauty every year with the natural growth of the sylvan subjects that have been brought together within her gates. This, with the soul that is centred in the capital, make the home of the Federation a city of enchantment. There is nothing to match it in the southern seas. And all because the man who had to do with the tree plantings was big enough in heart and mind to break away from the conventional methods of tree work, and develop new beauty with well-balanced plantings of colourful evergreen, deciduous, and flowering trees.

Canberra is a national influence to-day. Her radiations reach the ends of the continent, her inspirations are working into new forms of loveliness all over the land. How could it be otherwise?

Only a few weeks ago the Prime Minister (Mr. Lyons), with kindliness and good grace, took his place among the nation's tree planters and left a memory tree in splendid company at Faulconbridge, near to the home of the late Sir Henry Parkes, the founder of our Australian Federation. Not often have I seen so simple a ceremony enacted in so fine a spirit. The Prime Minister did the work as one who was greatly honoured to leave a tree in such a hallowed situation.

The Premier (Mr. Stevens) has his tree on the same landscape. Not far away King George's tree stands as the treasure tree of the Blue Mountain highways.

The 1934 tree planting season has been a triumph for the new-day tree planters and for the colourful deciduous and flowering trees. Canberra has been the inspiration behind the best of the work done during the year, for which the tree lovers are glad.

Orchard Notes for December.

THE COASTAL DISTRICTS.

THE planting of pineapples and bananas may be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these Notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every chance to get a good start; if checked when young they take a long time to pull up and the fruiting period is considerably retarded. Small areas well worked are more profitable than large areas indifferently looked after, as the fruit they produce is of very much better quality. This is a very important matter in the case of both of these fruits, as with the great increase in the area under crop there is not likely to be a profitable market for inferior fruit. Canners only want first-class pines of a size that will fill a can, and cannot utilise small or inferior fruit, except in very limited quantities, and even then at a very low price. Small, badly filled bananas are always hard to quit, and with a well-supplied market they become unsaleable. Pineapple growers, especially those who have a quantity of the Ripley Queen variety, are warned that the sending of very immature fruit to the Southern markets is most unwise, as there is no surer way of spoiling the market for the main crop. Immature pineapples are not fit for human consumption, and should be condemned by the health authorities of the States to which they are sent.

Citrus orchards require constant attention; the land must be kept well worked and all weed growth destroyed. Spraying or cyaniding for scale insects should be carried out where necessary. Spraying with fungicides should be done where the trees show the need of it. A close lookout must be kept for the first indications of "maori," and as soon as it is discovered the trees should either be dusted with dry sulphur or sprayed with the lime sulphur, potassium, or sodium sulphide washes. Borer should be looked for and destroyed whenever seen.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to quit.

Peaches, plums, papaws, and lemons will be in season during the month. See that they are properly handled. Look out for fruit fly in all early ripening stone fruit, and see that none is left to lie under the trees to rot and thus breed a big crop of flies to destroy the mango crop when it ripens.

Keep leaf-eating insects of all kinds in check by spraying the plants on which they feed with arsenate of lead.

Look out for Irish blight in potatoes and tomatoes, and mildew on melons and kindred plants. Use Bordeaux or Burgundy mixture for the former, and finely ground sulphur or a sulphide spray for the latter.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

EARLY ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle, as the old saw, "Early ripe, early rotten," applies to all of them; in fact, the season of any particular variety is so short that it must be marketed and consumed as quickly as possible. All early ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. The available markets are quickly over-supplied with this class of fruit, and a glut takes place in consequence. Merchants frequently make the serious mistake of trying to hold such fruits, in the hope of the market improving, with the result that, instead of improving, the market frequently becomes more and more congested, and held-over lines have to be sent to the tip. There is only one way to deal with this class of fruit, and that is to clear the markets daily, no matter what the price, and get it distributed and into consumption as rapidly as possible by means of barrowmen and hawkers. Most early ripening fruits are useless for preserving in any way, their only value being what they will bring for consumption whilst fresh. This being so, it is only a waste of time and money to forward immature, undersized, and inferior fruit to market, as it is not wanted, and there is no sale for it. It should never have been grown, as it is frequently only an expense to the producer, besides which, unless the fallen or over-ripe fruit is regularly and systematically gathered and destroyed in the orchard, it becomes a breeding ground for fruit fly and codlin moth, as well as of fungi, such as those producing the brown

and ripe rots. Early ripening fruits should, therefore, be carefully graded for size and quality, handled, and packed with great care, and nothing but choice fruit sent to market. If this is done, a good price will be secured, but if the whole crop—good, bad, and indifferent—is rushed on to the local markets, a serious congestion is bound to take place and large quantities will go to waste.

Orchards and vineyards must be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, excepting, of course, there is a good fall of rain sufficient to provide an ample supply of moisture.

Codlin moth and fruit fly must receive constant attention and be kept under control, otherwise the later-ripening fruits are likely to suffer severely from the depredations of these serious pests.

Grape vines must be carefully attended to and sprayed where necessary for black spot or downy mildew, or sulphured for oidium. Where brown rot makes its appearance, spraying with the potassium or sodium sulphide washes should be carried out. Leaf-eating insects of all kinds can be kept in check by spraying with arsenate of lead.

Farm Notes for December.

ALTHOUGH November is regarded generally as the best period for planting the main maize crop, on account of the tasseling period harmonising later on with the summer rains, December planting may be carried out in districts where early frosts are not prevalent, provided a known quick maturing variety of maize is sown.

To ensure a supply of late autumn and winter feed, dairymen are advised to make successive sowings of maize and sorghums, to be ultimately used either as green feed or in the form of ensilage. The necessity for such provision cannot be too strongly urged. Farmers who have not had any experience in building an ensilage stack can rest assured that, if they produce a crop for this purpose, information and instruction on the matter will be given on application to the Under Secretary for Agriculture and Stock; also that, whenever possible, the services of an instructor will be made available for carrying out a demonstration in ensilage-making for the benefit of the farmer concerned and his immediate neighbours.

In districts and localities where supplies of lucerne are not available, sowings of cowpeas should be made, particularly by dairymen, as the lack of protein-yielding foods for milch cows is a common cause of diminished milk supplies and of unthriftiness of animals in dairy herds. Cowpeas and lucerne can be depended upon to supply the deficiency. The former crop is hardy and drought-resisting. When plants are to be used as fodder, it is customary to commence to feed them to stock when the pods have formed. Animals are not fond of cowpeas in a fresh, green state; consequently the plants should be cut a day or two before use. Economy is effected by chaffing beforehand, but the plants can also be fed whole. Chaffed in the manner indicated, and fed in conjunction with green maize, or sorghum, when in head, in the proportion of one-third of the former to two-thirds of the latter, a well-balanced ration is obtainable. Animals with access to grass land will consume from 40 to 50 lb. per head per day; a good increase in the milk flow is promoted by this succulent diet. The plant has other excellent attributes as a soil renovator. Pig-raisers will find it invaluable also.

A great variety of quick-growing catch crops, suitable for green fodder and ensilage purposes, may also be sown this month, notably Sudan grass, white panicum, giant panicum (liberty millet), Japanese millet, red and white French millet. Well prepared land, however, is required for crops of this description, which make their growth within a very limited period of time. French millet is particularly valuable as a birdseed crop, the white variety being more in favour for this purpose.

Successive sowings may be made of pumpkins, melons, and plants of this description.

In districts where onions are grown, these will now be ready for harvesting. If attention is given, in the case of garden plots, to bending over the tops of the onions, maturity of the crop is hastened. Evidence will be shown of the natural ripening-off process, and steps should be taken to lift the bulbs and to place them in windrows until the tops are dry enough to twist off. If a ready market is not available, and it is decided to hold over the onions for a time, special care should be taken in handling. Storage in racks in a cool barn is necessary; otherwise

considerable deterioration is to be expected. Improved prices are to be looked for in marketing by grading and classifying produce of this description.

Cotton areas which were subjected to a thorough initial preparation, thereby conserving a sufficiency of moisture for the young plants, should now be making good headway and sending their taprooots well down. Keep down all weed growth by scarifying as long as the growth will admit of horse work.

A LAND LEVELLER.

HOME-MADE, BUT EFFICIENT.

The originator of the idea wrote as follows:—"The type of leveller shown on the top is very good for filling in small furrows. If it is not heavy enough for rough fallow, a log can be tied on the two iron distance pieces, or a board to stand on can be provided. For ordinary work three horses are sufficient. The paddock should be worked from corner to corner—diagonally. The leveller does good work before the drill, and it is better than the harrows for killing weeds, as it crushes them up, leaving the roots clean. A light implement does excellent work after the drill. I have used the leveller of the sort illustrated in the second sketch on this page with

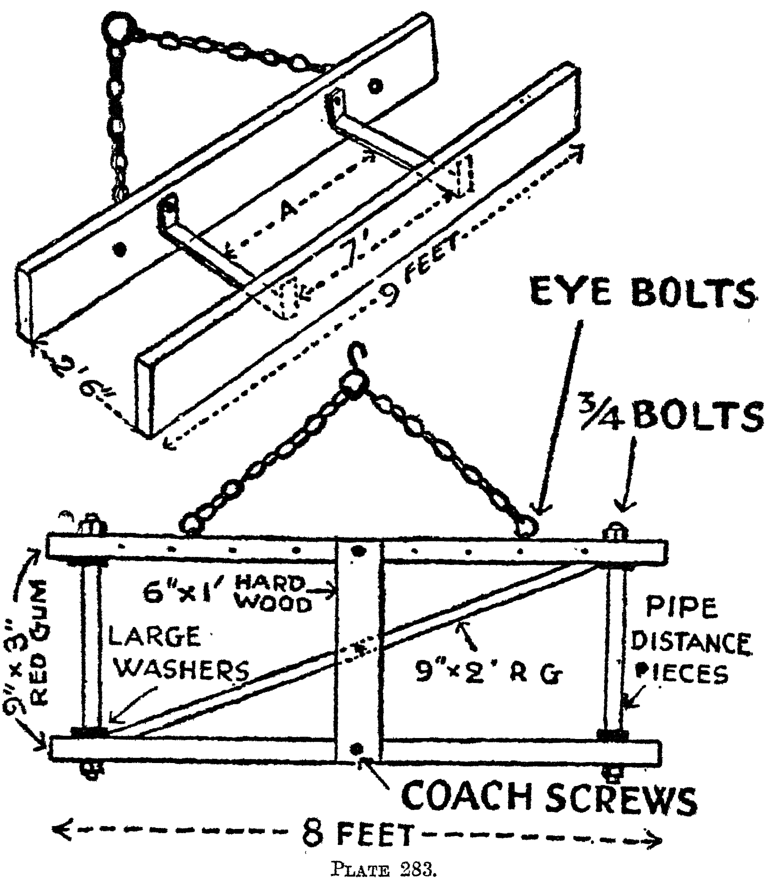

Plate 283.

excellent results on fallow before breaking down. This levels and breaks all lumps on the top, and also loosens the soil before the scarifier or the cultivator. The front piece is studded with old bolts, driven in and allowed to project 2 in. The back piece can be treated the same way. On very hard or rough fallow it is necessary to stand on the implement, or use a seat. It can be weighted to suit dry ground, and takes four to five horses. It can be used in the same direction as the ploughing.—"The Canegrowers Weekly" (Mackay), Q.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING SEPTEMBER, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of Years' Re-cords.	Sept., 1934.	Sept., 1933.		Sept.	No. of Years' Re-cords.	Sept., 1934.	Sept., 1933.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	0·66	33	2 33	1·41	Clermont	1·05	63	0·18	1·92
Cairns	1·66	52	2·23	2·55	Gindie	1·13	35	0·06	5·27
Cardwell	1·54	62	1·92	4·02	Springsure	1·32	65	0·36	5·18
Cooktown	0·57	58	0·62	0·38					
Herberton	0·52	48	2·46	1·02					
Ingham	1·58	42	1·61	6·17					
Innisfail	3·49	53	5·48	4·90					
Mossman Mill	1·56	21	1·67	5·24	*Darling Downs.*				
Townsville	0·81	63	0·18	0·92					
					Dalby	1·69	64	0·80	2·83
Central Coast.					Emu Vale	1·76	38	1·67	1·91
					Hermitage	1·54	28	1·71	2·01
Ayr	1·41	47	0·15	2·40	Jimbour	1·50	46	0·69	1·99
Bowen	0·83	63	0·67	1·95	Miles	1·35	49	0·52	1·97
Charters Towers	0·85	52	0·02	3·02	Stanthorpe	2·28	61	2·93	2·20
Mackay	1·57	63	0·98	1·54	Toowoomba	2·15	62	0·91	2·34
Proserpine	2·17	31	1·18	5·41	Warwick	1·83	69	1·16	2·33
St. Lawrence	1·30	63	0.92	1·83					
South Coast.									
Biggenden	1·56	35	0·95	2·97	*Maranoa.*				
Bundaberg	1·60	51	0·74	1·21					
Brisbane	2·02	83	1·33	4·28	Roma	1·44	60	0·12	3·52
Caboolture	1·89	47	0·37	3·16					
Childers	1·86	39	0·71	3·27					
Crohamhurst	2·74	41	1·04	8·10					
Esk	2·13	47	0·94	2·13					
Gayndah	1·58	63	2·06	3·45					
Gympie	2·15	64	0·42	4·15	*State Farms, &c.*				
Kilkivan	1·72	55	1·03	3·30					
Maryborough	1·97	63	1·16	3·73	Bungeworgorai	1·02	20	0·11	2·94
Nambour	2·58	38	0·96	4·55	Gatton College	1·57	35	..	1·89
Nanango	1·86	52	0·80	4·51	Kairi	0·63	20	1·68	0·65
Rockhampton	1·35	63	0·30	1·01	Mackay Sugar Ex-				
Woodford	2·24	47	0.55	5·07	periment Station	1·49	37	1·06	3·01

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·97	85	62	89	24	52	6	62	3
Herberton	..	75	55	88	29	44	6	246	9
Rockhampton	30·09	81	58	96	28	45	4	30	4
Brisbane	30·11	75	55	90	27	45	5	133	6
Darling Downs.									
Dalby	30·09	75	46	91	29	35	4	80	5
Stanthorpe	..	67	41	82	29	30	4, 14	293	11
Toowoomba	..	69	47	87	29	37	3, 8	87	5
Mid-Interior.									
Georgetown	29·99	89	63	98	30	53	3, 6	Nil	..
Longreach	30·05	85	54	104	29	39	7	Nil	..
Mitchell	30·09	77	44	97	29	32	4	31	3
Western.									
Burketown	29·99	88	64	97	23 24	52	7	Nil	..
Boulia	30·02	87	57	105	29	44	7	6	1
Thargomindah	30·06	79	54	97	29	43	7	15	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	November, 1934.		December. 1934.		MOONRISE. Nov. 1934.	MOONRISE. Dec., 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5·3	6·9	4·49	6·33	1·16	12·42
2	5·2	6·10	4·49	6·33	1·46	1·14
3	5·2	6·11	4·49	6·34	2·15	1 44
4	5·1	6·11	4·49	6·35	2·45	2·20
5	5·0	6·12	4·50	6·36	3·16	2·59
6	5·0	6·12	4·50	6·36	3·49	3·48
7	4·59	6·13	4·50	6·37	4·26	4·46
8	4·58	6·14	4·50	6·38	5·8	5·49
9	4·57	6·15	4·50	6·38	5·58	6·56
10	4·56	6·16	4·51	6·39	6·56	8·4
11	4·56	6·16	4·51	6·39	8 0	9·13
12	4·55	6·17	4·51	6·40	9·5	10·19
13	4·55	6·18	4·51	6·40	10·14	11·24
						p.m.
14	4·54	6·19	4·52	6·41	11·19	12·24
					p.m.	
15	4·54	6·20	4·52	6·41	12·23	1·26
16	4·53	6·21	4·52	6·42	1·25	2·26
17	4·52	6·21	4·52	6·43	2·26	3·27
18	4·52	6·22	4·53	6·44	3·28	4 28
19	4·52	6·23	4·53	6·44	4·30	5·28
20	4·51	6·24	4·53	6·45	5·34	6·22
21	4·51	6·25	4·54	6·45	6·35	7·12
22	4·51	6·26	4·54	6·46	7·35	7·59
23	4·50	6·27	4·55	6·46	8·30	8·39
24	4·50	6·28	4·55	6·47	9·20	9·13
25	4·50	6·28	4·56	6·47	10·4	9·46
26	4·50	6·29	4·56	6·48	10·41	10·15
27	4·50	6·29	4·57	6·48	11·16	10·43
28	4·49	6·30	4·58	6·49	11·47	11·10
29	4·49	6·30	4.59	6.49	a.m.	11·40
30	4·49	6·31	4·59	6·50	12·14	a.m.
31			5·0	6·50		12·13

Phases of the Moon, Occultations, &c.

7 Nov.	● New Moon	2 44 p.m
14 ,,	☾ First Quarter	12 39 p.m.
21 ,,	○ Full Moon	2 26 p.m.
29 ,,	☽ Last Quarter	3 59 p.m.

Perigee, 12th November, at 12.45 p.m.
Apogee, 28th November, at 12.18 a.m.

The apparently very near approach of Venus to Jupiter would be most remarkable on November 1st and 2nd if it were not for their nearness to the Sun, which will rise only 16 minutes after the planets.

On the 3rd, Mercury will pass nearly between the Earth and the Sun, but being about half a degree further south will not cross the Sun's face. On the next day Mercury will pass from west to east of Venus, which will be about 1 degree north of it.

When Jupiter rises on the 7th about 4.20 a.m. Mercury will be passing from west to east of it, about a third of a degree on its southern side.

On the 11th, Mars and Neptune will be in the same part of Leo, near the border of Virgo within 1 degree of each other, but with an actual distance of more than 2,500 million miles.

On the 14th, at 4 p.m., Saturn will be only 3 degrees (half the length of the Southern Cross) south of the Moon in its first quarter, in the north-east; a spectacle for telescope or binoculars will then be afforded.

On the 18th, Venus will be on the far side of its orbit beyond the Sun, but about half a degree to the north of it, and about 160 million miles from the Earth. Venus will therefore be unobservable in November.

Mercury will take its place as a morning star, having its greatest elongation 19 degrees west of the Sun, on the 19th.

On the 21st at 4 a.m., Mercury will be apparently within three diameters of the Moon north of Jupiter, which will be an interesting spectacle for those using telescope or binoculars.

Mercury will set 24 minutes after the Sun on the 1st; on the 15th it will rise at 4.1 a.m. or 53 minutes before the Sun.

Venus will rise at 4.52 a.m., or 11 minutes before the Sun on the 1st, and only 5 minutes before it in the 15th.

Mars will rise at 2.16 a.m. on the 1st and at 1.43 a.m. on the 15th.

Jupiter will rise at 4.55 a.m. and set at 5.53 p.m. on the 1st; on the 15th it will rise at 4.9 a.m. and set at 5.13 p.m.

Saturn will rise at 12.16 p.m. and set at 1.30 a.m. on the 1st; on the 15th it will rise at 11.20 a.m. and set at 12.37 a.m.

7 Dec.,	● New Moon	3 25 a.m.
13 ,,	☾ First Quarter	8 52 p.m.
21 ,,	○ Full Moon	6 53 a.m.
29 ,,	☽ Last Quarter	12 8 p.m.

Perigee, 9th December, at 6 p.m.
Apogee, 25th December, at 7.36 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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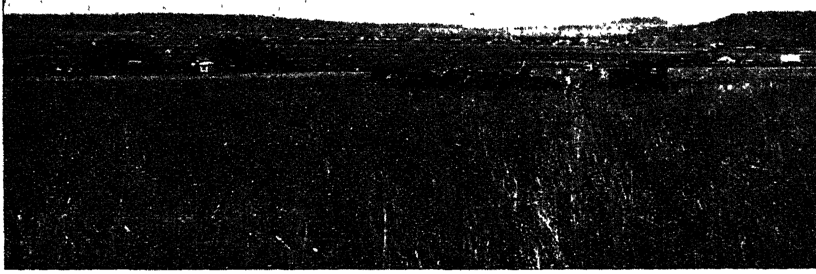
QUEENSLAND AGRICULTURAL JOURNAL



VOL XLII. | 1 DECEMBER, 1934. | PART 6.

Event and Comment.

An Australian Agricultural Council.

AT a recent conference of Federal and State Ministers at Canberra a proposal to form an Australian Agricultural Council was adopted unanimously. Wide powers and many responsibilities will be given the newly-formed Council, which, it is hoped, will function permanently as a body, having as its objective the promotion of the welfare of agricultural industries and the formulation of national policies. The functions of the Council will be:—

To promote the welfare and development of agricultural industries.

To arrange the mutual exchange of information regarding agricultural production and marketing.

To co-operate for the purpose of ensuring the improvement of the quality of agricultural products and the maintenance of high-grade standards.

To ensure balance between production and available markets.

To consider the requirements of agricultural industries in regard to organised marketing.

To promote the adoption of a uniform policy on external marketing problems, particularly those pertaining to the negotiation of intra-Empire and international agreements.

To consult in regard to proposals for the grant of financial assistance to agricultural industries.

To consider questions submitted to the Council by a new standing committee in agriculture.

The conference decided to create an enlarged standing committee on agriculture, which will be a technical body, to advise the Commonwealth and State Governments and to secure co-operation and co-ordination in agricultural research and quarantine matters throughout the Commonwealth. The standing committee will comprise the permanent head of the State Departments of Agriculture, members of the executive committee of the Council for Scientific and Industrial Research, the secretary to the Department of Commerce, and the Director-General of Health.

Tobacco Experiment Work.

ANSWERING some criticism of departmental activities in respect of tobacco experiment work in the far North, in the course of a recent debate in Parliament, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said:—

Some question was raised as to whether the department should not have taken over the Commonwealth tobacco experiment farm at Mareeba. This Committee is entitled to know why I refused to take this farm over. I was guided in my decision by the considered opinion of experienced agriculturists and experimentalists in all parts of the world. Hon. members will realise that at one time it was a recognised policy in Queensland to have centrally situated experiment farms in each divison of the State. I think the hon. member for Cooroora (Mr. Harry F. Walker) must subscribe to my policy, because during his administration he got rid of two or three experiment farms. I frankly admit that I have got rid of experiment farms since I have been Minister. My reason is that, after all, an experiment farm generally only has one soil type. The result is that notwithstanding considerable expense to the State it may be of very little value in another district, perhaps not 100 miles distant. Experimental work, to be of any advantage, must deal with various soil types and a diversity of agricultural subjects, rather than with one soil type in one climate. It was because those reasons were uppermost in my mind, to which I ardently subscribe, that I refused to take over the Mareeba tobacco experiment station. Several years of experimental work had been done there. That work had not been materially successful. There was one phase, even if other phases did not exist, that induced me to reject the Commonwealth offer. It was a fact that after six or seven years' extensive cropping disease problems of outstanding importance would have hampered any cultural operations we were conducting. The Commonwealth Government has undertaken research work into disease problems in the tobacco industry, and have delegated to the State the cultural work that is necessary. If we are to undertake the cultural work it would not be fair to suggest that we should undertake that cultural work handicapped by having to use an old experimental station that in its earlier days had been saturated with disease spores that are difficult to control, as, for example, frog-eye and blue mould. Speaking from memory, we

have twenty or thirty tobacco plots under experimental observation, and I think our present policy of having the tobacco experimental work scattered throughout the whole of the State is a better policy than its concentration in one area.

I believe that the whole experiment policy of the department, not only in regard to pasture improvement but also in regard to cultural experimental work generally, should be distributed over the widest possible area. There should be no centralised experiments for cultural work. Experiments for pathological observation and research on the other hand should be conducted within easy reach of the most highly skilled officers in my department, who are the men in control of the branches at the head office. That is a policy I have pursued. It is certainly an expensive one. All agricultural research work, indeed all research work, is expensive, but I view the question in this way—and my officers fortunately share my views—that it is not expenditure in the true sense of the word. Rather is it an investment, and if we did not strenuously continue an experimental policy in all its various facets, then agriculture would decline instead of progress.

The Year in Agriculture.

IN the Annual Report of the Department of Agriculture and Stock, the Under Secretary and Director of Marketing, Mr. E. Graham, states that, if viewed solely from the production standpoint, the year was a successful one in practically every branch of rural industry. This result was due to favourable seasonal circumstances, a steady improvement in farming efficiency, and higher standards of animal husbandry, which are becoming more evident every year.

The administrative, advisory, research, and regulatory functions of the Department have been maintained in accordance with the State's broad and comprehensive policy of sound rural development.

The interval between the discovery and application of new knowledge of practical value has been reduced by close correlation of the research and advisory services in respect of the varied and extensive activities of the Department.

The departmental year has been marked, too, with a sincere, sustained, and, to some extent at least, successful endeavour to surmount the perplexities of the economic position. Economically, the agricultural situation is still very serious. The price position, in the dairy and fruit industries particularly, is far from satisfactory. Improved wool values have had, however, a stimulating effect.

Although marketing difficulties continue—difficulties that shall certainly be increased should a policy of further restriction of exports and regulation of crop acreages be enforced—there is some evidence that the worst of the depression, which has affected agriculture in common with other industries so seriously in recent years, has passed.

Every effort to improve the marketing position of all primary products, in the best way possible in the circumstances, was made during the past year. In this connection, it is repeated that Queensland farmers are fortunate in their system of organised marketing which has proved, during recent difficult years, the best protection that they could have.

Queensland Fruit Fly Control.

By ROBERT VEITCH, B.Sc., Agr., B.Sc., For., F.R.E.S.,
Chief Entomologist.

THE maggots of the Queensland Fruit Fly feed voraciously in the fruit of many trees and other plants, deciduous fruit being particularly susceptible to attack. Citrus, papaw, and mango may also suffer severely, but fortunately the banana is very rarely attacked and then only in the case of over-ripe bunches, which should be cut solely for home or local consumption. The maggots tunnel throughout the fruit, destroying much tissue in their progress and setting up decomposition, the combined effect being to render the fruit unfit for marketing.

Life History and Habits.

The creamy coloured slightly curved eggs of the Queensland Fruit Fly are laid in batches of as many as six or seven in the tissue of the selected fruit just underneath the puncture made in the skin thereof by the female fly. The eggs hatch in two or three days in midsummer, and the creamy white legless tapering maggot feeds throughout the tissue of the fruit. The full size of about one-third of an inch in length is attained in a week in the warmer weather, and the maggot then leaves the fruit and pupates in the soil just below the surface. The pupa is formed within a hard-shelled reddish-brown pupal case, and in this non-feeding stage the maggot's tissues undergo a complete reorganisation resulting in the production of the prettily marked reddish-brown fly at the end of about one week in midsummer. The life cycle may thus be completed in a fortnight in summer, but in the colder months all the life-cycle stages are of much longer duration.

Disposal of Infested Fruit.

Successful control of this pest necessitates strict attention to orchard hygiene, and all waste and fly-infested fruit should accordingly be promptly gathered up and adequately disposed of. If fallen infested fruit is allowed to lie on the ground the fruit-fly maggots contained therein will leave the fruit on becoming full grown and will pupate in the soil to produce a fresh brood of flies. When the infested fruit has been gathered up it may be disposed of by burying, boiling, burning, or immersing in water. If the fruit is buried care should be taken to ensure that it has a soil covering of at least 18 inches, for if only a light covering is given the flies will succeed in completing their development and emerging from the soil. None of these methods of disposal are ideal, and hence it has been decided, that, at least in so far as the Stanthorpe district is concerned, the pit method of disposal is more satisfactory. The pit should be 6 feet by 5 feet with a depth of 20 feet, and a suitable fly-proof cover should be provided. The waste and infested fruit soon ferments when tipped into such a pit, and the fruit-fly maggots are killed by the fermentation process. Pits of somewhat smaller dimensions are employed in the citrus districts; boiling is also a favourite method of disposing of fly-infested citrus.

Luring.

Luring has been demonstrated to be a successful control measure in the deciduous fruit orchards, and a departmental lure much used

therein has the following formula for a five to one strength:—Five tablespoonfuls of liquid household ammonia; five teaspoonfuls of imitation vanilla essence, and 26 ounces of water—i.e., one winebottleful. An eggcupful of the concentrated lure prepared according to that formula is added to five eggcupfuls of water, and that quantity is sufficient for the baiting of one trap. The lure is placed in glass fly traps, which are generally obtainable at a cost of 1s. 6d. each, and these are placed in suitable trees. Large leafy trees in a sheltered position should be selected and the traps placed in the shadiest portions thereof, being suspended by tie wire. The traps should receive regular attention, the lure being renewed as required.

Readers are reminded that this lure was evolved for use in deciduous fruit orchards, and its application in citrus and other orchards may not be attended with the same degree of success as has been experienced at Stanthorpe. Furthermore, in citrus orchards the best trees for luring may be those in the most exposed position, whereas, as already indicated, sheltered trees are the most suitable in the deciduous fruit orchards. The suitability of particular citrus trees for luring purposes may be determined by observing the amount of fallen fly-infested fruit under the trees.

Repellent Sprays.

Repellent sprays have already been the subject of departmental experiments at Stanthorpe and in connection therewith readers may be interested to know that ½ pine of nicotine sulphate and ½ gallon of white spraying oil to 40 gallons of water gave very promising results as a fruit-fly repellent in a Severnlea apple orchard. Before this repellent spray can be recommended as safe and effective these experiments will, of course, have to be repeated to decide whether this particular spray will live up to the early promise of success and, furthermore to determine whether or no any cumulative ill-effect is produced by the oil in the repeated applications necessary at intervals of one week during the course of a fruit-fly invasion. The effect on fruit other than apples will also have to be determined.

Elimination of Non-commercial Fruit Trees.

Where practicable all useless non-commercial fruit trees known to breed fruit flies should be eliminated, for they merely act as an additional source of infestation for the commercial trees.

Covering Trees.

Covering the trees with such material as old mosquito-netting will prevent the flies gaining access to the fruit for egg-laying purposes. Such a control measure, of course, can be adopted only in cases where a few small garden trees require protection.

Parasites of Cattle.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

EXTERNAL PARASITES.

The most important external parasites of cattle are lice, mange mites, ticks, and the buffalo fly.

LICE.

Three distinct species of lice infest cattle. Two of these, *Hæmatopinus eurysternus* and *Linognathus vituli,* are sucking lice. The third species, *Bovicola bovis,* is a biting louse.

The Biting Louse (Bovicola bovis).

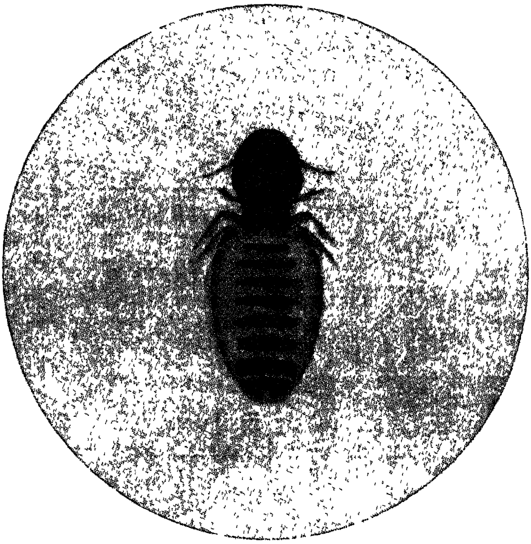


PLATE 284.—THE BITING LOUSE (*Bovicola bovis*).

This is a small yellowish louse with a broad, blunt, reddish-head. This species usually infests the withers and rump, sometimes extending along the back between these two sites. Their presence causes a scurfy condition of the skin, and the constant rubbing and scratching by the irritated animal may cause the formation of raw hairless patches. Eggs laid by the female louse are glued to the hairs and hatch in about ten days.

Sucking Lice.

The two species of sucking lice are quite distinct in appearance, so much so that *Hæmatopinus eurysternus* (Plate 285) is called the short-nosed sucking louse and *Linognathus vituli* (Plate 286) the long-nosed sucking louse.

The short-nosed sucking louse may measure up to $\frac{1}{8}$ of an inch in length. The head is short, bluntly-pointed, and about as broad as long. The abdomen is greyish in colour, the head and thorax yellow. The eggs

hatch in about eleven to eighteen days, and the young lice become mature in another twelve days. This species is usually found on adult cattle.

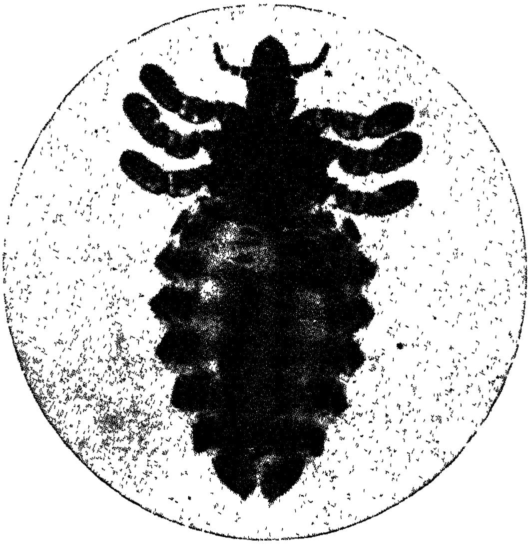


PLATE 285.—THE SHORT-NOSED SUCKING LOUSE (*Hæmatopinus eurysternus*).

The long-nosed sucking louse is a smaller and more slender species, the head being about twice as long as broad. The eggs hatch ten to fourteen days after being laid by the female, and the young lice reach the mature stage in another eleven days. This is the sucking louse commonly met with on calves and young cattle.

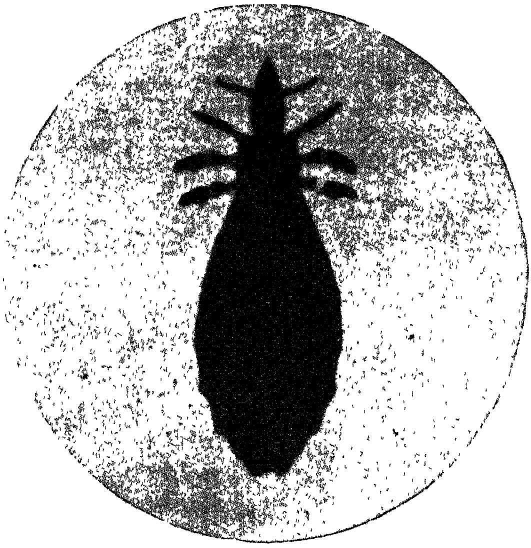


PLATE 286.—THE LONG-NOSED SUCKING LOUSE (*Linognathus vituli*).

For the most part sucking lice infest those portions of the body from which it is difficult for the animal to dislodge them. They usually feed in groups and are found on the head, sides of the neck, brisket, back, tail, scrotum, and inner surfaces of the thighs. The tail is a favoured site of attack, and it is not uncommon in cases of heavy infestation to see the switch of the tail literally covered with eggs.

When feeding, the lice, by means of their piercing and sucking mouthparts, pierce the skin and suck up the blood and fluids. Their habit of feeding in clusters not only increases any irritation and annoyance that follows the insertion of the mouthparts into the skin, but may also cause the formation of large scabby areas. In general, sucking lice may so lower the vitality of the infested animals that these are unable to withstand unfavourable conditions, eventually becoming poor and unthrifty.

Control of Lice.

The main method of spread is by contact between infested and clean animals, but it must be remembered that lice are able to live a few days if separated from their hosts. For this reason stables, &c., in which lousy cattle have been housed should be thoroughly cleaned out and disinfected to kill any dislodged lice and eggs.

Moderate and confined infestations of individuals may be treated with oils (sump oil, crude oil) or dip washes; for herd infestation dipping in an arsenical dip will be found satisfactory. The treatment should be repeated after fifteen-day intervals, at least two treatments being required.

MANGE.

Mange is caused by small species of mites which live under or on the skin. This disease condition is not considered to be prevalent among cattle in Queensland.

Before any treatment is attempted it is necessary to determine the type of mange present. This can only be done by taking skin scrapings and forwarding them to the laboratory for diagnosis.

Mange usually occurs on areas where the skin is tender and the hair is sparce. The infested skin becomes inflamed and swollen and scabs are formed. Eventually the skin becomes thickened and thrown into folds.

Dipping in a lime sulphur dip is necessary to control mange.

THE CATTLE TICK (Boophilus microplus).

A B

PLATE 287.—THE CATTLE TICK (*Boophilus microplus*).

Description.

Several species of ticks have been recorded from cattle in Queensland, the most common and most important species being the common cattle tick, *Boophilus microplus* (*B. australis*). The female tick (Plate 287 (B)) at first is small, grey in colour, with a few irregular yellow markings. As she engorges with blood the grey colour changes to a dark-red, and when fully engorged this sex may measure about half an inch in length. The male (Plate 287 (A) is minute in size, measuring about one-tenth of an inch. In both sexes the mouthparts are placed at the narrower anterior end of the body and are brownish in colour and inconspicuous. The pale, flesh coloured legs readily distinguish the common cattle tick from other species of ticks, such as wallaby ticks, kangaroo ticks, the dog tick, &c., that are occasionally seen on cattle.

Life History.

The female tick when fully engorged drops from the host and crawls to some sheltered spot to begin her egg laying. The eggs are spherical brownish bodies and are deposited in masses, as many as 4,000 being laid by a single female. Under favourable conditions these hatch in about fifteen days, and the tiny six-legged larvæ or seed ticks emerge. After a time, sufficient for the body parts to harden, the larvæ crawl up the grass from which they are brushed on to the animal as it passes by. These larvæ are very tenacious of life and may live as long as 154 days in the absence of cattle. Once on the beast the tiny ticks distribute themselves over the body, seeking spots where the skin is soft and thin. Having found a suitable place the proboscis is inserted and the young tick commences to suck blood. After about six to ten days the larva is fully engorged. It then casts its skin and the next stage in the life history—the eight-legged nymph—appears. The nymph reattaches itself to the same spot on the animal or near it and becomes engorged after about another seven days. A second moult then occurs and the adult stage makes its appearance. Reattaching herself the female tick may be fully fed in seven to ten days. She then drops from the animal, lays her eggs, shrivels up, and dies. The male, on the other hand, following the moulting of the nymph, feeds intermittently and spends its life searching out the females.

The Economic Importance of the Cattle Tick.

The cattle tick first entered Queensland from the Northern Territory in 1891, and at the present time has spread throughout the coastal and northern portions of the State.

It is an extremely important pest of cattle and heavy infestations cause tick worry and anæmia, which may in themselves be serious enough to result in death. Among dairy cattle this tick may produce a serious decrease in the milk yield.

Its greatest importance, however, lies in the fact that it is a vector or carrier of two organisms which are responsible for serious diseases among cattle. These organisms are *Babesia bigeminum* and *Anaplasma marginale*,* which produce "redwater" and anaplasmosis, respectively, in cattle.

* Although the common cattle tick is not as yet implicated in the spread of Anaplasmosis in Australia, experiments conducted in the United States have shown it to be able to transmit this disease.

THE BUFFALO FLY (Lyperosia exigua).

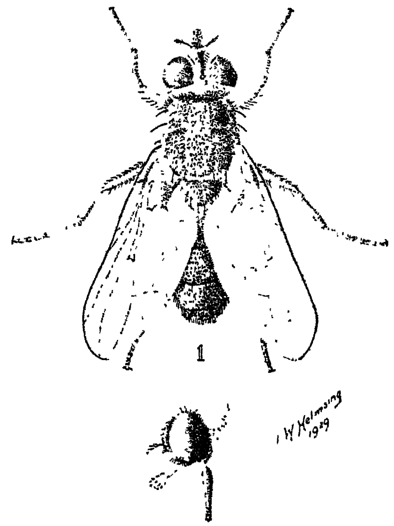


PLATE 288.

(1) Adult × 8. (2) Lateral view of head showing sucking mouthparts.

The buffalo fly affords an excellent example of an insect which, whilst unimportant in its native country, has upon introduction into a new land become a pest of serious dimensions. In the East Indies the fly is almost unknown as a harmful parasite of stock, but in Australia it bids fair to rival the cattle tick as a stock pest of outstanding importance. The reason for this may probably lie in the freedom it enjoys in Australia from the attacks of other insects which in the East Indies so parasitise it as to keep it under control. An alternative explanation may be found in a climatic or some other condition present in Australia which is more favourable to its development and rapid increase.

The buffalo fly belongs to the dipterous family Muscidæ, which, besides the house fly, the bush flies, and blowflies, includes a number of biting flies, other species of which are the stable fly of cosmopolitan distribution and the infamous tsetse flies of Africa.

The genus *Lyperosia* contains representative species in various parts of the world. *Lyperosia exigua* is known from the East Indies and Australia; *Lyperosia irritans*, the "horn fly" of the United States, was introduced from Europe and is a serious pest of cattle in the former country. Three further species occur in the Soudan, all very common, but not regarded as very important parasites of native stock. One of these species, *Lyperosia minuta*, has been introduced to the Transvaal and Zanzibar, but in the latter country only is it regarded as a harmful pest of cattle.

Distribution in Australia.

The buffalo fly is thought to have been introduced into Australia with the first herd of buffaloes which landed at Darwin somewhere

about 1825. For many years it remained confined to the country in and around Darwin, and it was not until 1911 that it attracted attention as a pest of cattle. At this time it occupied a range of country extending from the Liverpool River on the east to the Daly River on the west and bounded on the south by the Roper River, the coast line, of course, representing the northern limit. During the next fifteen years extensive movements of cattle occurred and the fly rapidly spread, so that at the end of this period its area of distribution extended from Broome, West Australia, to the Robinson River on the east, and to the watershed of the coastal rivers on the south—an area practically four times as large as that occupied in 1911. It first crossed the far north-western border of Queensland in 1928, and at the present time is confined to this corner of the State.

Description and Habits.

The buffalo fly is a small dark-grey, biting fly, a little more than half the size of the ordinary house fly. (*See* Plate 288.) Primarily a parasite of the buffalo, the insect has turned its attention to other animals, including cattle, horses, and man, for the purpose of obtaining food, cattle constituting the principal host. Horses and man are usually attacked only at such times as they are among infested cattle.

Unlike other biting flies such as mosquitoes, march flies, and sand-flies, which visit the host only at such time as food is required, the buffalo fly remains on the animals night and day, and only when disturbed or for the purpose of laying eggs does it leave the host. When not feeding they rest in groups on the neck, shoulders, bellies, rumps, and horns. Both male and female flies feed on blood, and for this purpose they force their way down among the hairs, elevate the wings, and assume an almost erect position. When disturbed the speed of their flight is astonishing, for although covered by the hairs of the hide, at a switch of the tail or a toss of the head, the flies instantly rise in a cloud for some little distance, returning again as quickly and resuming feeding.

Life History.

The Egg.

The egg of the buffalo fly is a tiny, elongate, creamy yellow body, and is deposited by the female in the freshly-dropped dung of cattle and buffaloes. It was thought that the dung of native animals—kangaroos, wallabies, &c.—and that of horses might prove suitable for the development of the fly, but so far attempts to breed the flies under natural conditions from the dung of these animals have been negative. Unlike bovine fæces, this type of dung is apparently too dry for larval development. As soon as fresh fæces are dropped, the female flies leave the animal to lay their eggs therein, the egg being deposited either on the surface or else in cracks and crevices. A number of eggs may be deposited in the one spot by a single female, which may lay many such batches in the one season. Under suitable conditions of temperature and moisture the egg may hatch in eighteen to twenty-four hours. Dryness and exposure to sunlight are harmful to the egg, which under such conditions rapidly decomposes.

The Larva.

The larva is a typical fly maggot, small in size and dirty white in colour. On hatching from the egg it immediately burrows into the dung, and keeps on burrowing as the surface layers dry out. Growth occurs fairly rapidly, and in three to five days the maggot is fully grown and ready to pupate.

The Pupa.

When ready to pupate the fully-grown maggot may either remain in the dung or else descend into the soil. The larval skin contracts, hardens, and turns brown. Within this brown, hardened case transformation of the larva to the adult takes place. This stage occupies three to five days, at the end of which the adult fly emerges, dries its wings, and is ready for its parasitic existence.

Duration of Life Cycle.

The complete life cycle occupies seven to eleven days under favourable conditions, the period, of course, being lengthened during the winter months or at any such times as the conditions are adverse to the fly's development.

Seasonal Distribution.

Although the buffalo fly is never quite absent throughout the year, there is a very marked seasonal variation. During the dry winter months the insects are so scarce as to warrant a most careful inspection of individual animals to detect their presence. Commencing with the advent of the rainy season in November they become more numerous, and in the wet months of January and February are at their maximum, gradually becoming less frequent with the approach of May and June.

Economic Importance.

No evidence has yet come to hand that the buffalo fly may be a vector of some deadly disease, but the possibility should always be borne in mind. The cattleman is only too familiar with the worry and irritation cattle suffer through the occasional attacks of mosquitoes, sandflies, and march flies, and with this knowledge the harm that such a parasite as the buffalo fly in its countless numbers and constant attendance may accomplish can well be imagined. Infested animals lose condition fairly rapidly, not only as a result of the blood-sucking habits of the flies, but also through the worry and irritation caused by their presence. When the pest is present in numbers, cattle are kept constantly on the move and feed only at such times as they may gain respite from the fly's attack. As a loss in the milk yield is associated with the presence of the horn fly in the United States, it is reasonable to assume that a similar loss in yield also occurs in the case of the buffalo fly. Moreover, its bite is particularly severe, and the efforts of the beasts to rid themselves of its presence by rubbing the affected parts against posts, tree trunks, &c., causes the formation of large raw areas which attract other muscid flies—the bush fly and blowflies—which are conducive of further distress. Buffalo fly attack is already producing a noticeable effect on the cattle industry of the North, and

should the infestation ever include the dairy and main beef herds of Queensland the loss will become very serious.

INTERNAL PARASITES.

So far as can be ascertained, cattle in Queensland are not affected by internal parasites to the same extent as any of the other domesticated animals. Little is known of the prevalence of worms among the beef herds, but as these cattle are confined for the most part to the driest part of the State it is not considered that worms would be of any economic importance in so far as they are concerned. The dairy herds, on the other hand, occupy country with a comparatively high rainfall. Calves are weaned almost at birth and are subjected to treatment which would considerably lower their resistance to infestation, and it is mainly among animals of this class that losses following worm infestation are reported.

FLUKES.

Two species of flukes occur in cattle, the conical fluke, *Paramphistomum cervi,* and the liver fluke, *Fasciola hepatica.*

The conical fluke (Plate 289), as its name implies, is conical in shape and is found in the large or first stomach. It is extremely common in Queensland and is often present in very great numbers. It is, however, not considered to be harmful to any noticeable extent.

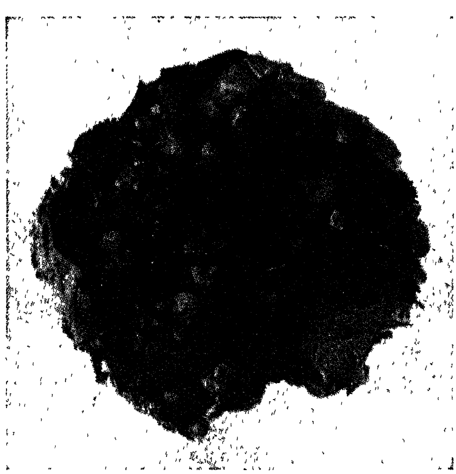


PLATE 289.—THE CONICAL FLUKE (*Paramphistomum cervi*).

The liver fluke occurs in the bile ducts of the liver, and is the same species as is found in the liver of sheep. Fortunately, it is of little importance, as it is of rare occurrence only.

With both species a snail is necessary as the intermediate host before the life cycle can be completed.

TAPEWORMS.

Cattle may act as the intermediate host of at least two very important tapeworms. The first of these is an extremely important parasite of man and is known as the beef tapeworm, *Tænia saginata.* Its larval form, *Cysticercus bovis,* is found in various parts of the body of cattle, usually in the muscles. Fortunately, beef measles, which is the name given to the infestation of cattle with the larval tapeworm, is unknown in Queensland.

The second species of larval tapeworm found in cattle is called *Echinococcus granulosus,* the common name given to this stage in the life history being "hydatids." The adult tapeworm occurs in the dog, and as hydatids is also a very important disease of man and propagated mainly through feeding raw offal containing the larval stage to dogs, control is only possible when all offal is thoroughly cooked before being fed to the dog. In cattle, the liver and lungs are the principal portions of the body infested with the larval stage which takes the form of cysts or bladders of fluid.

Calves are occasionally infested with adult tapeworms, *Moniczia* spp., which are found in the small intestine. These tapeworms may grow up to 10 feet or so in length, but it is doubtful as to whether they are of any great importance, though in one or two instances in which very heavy infestations were encountered the animals were emaciated and were subject to frequent attacks of scours.

Treatment for Tapeworms.

Calves infested with tapeworms should be starved for twenty-four hours and then given 3 to 4 oz., according to age, of the following preparation. Food and water should be withheld a further four hours after treatment:—

White arsenic (95 per cent. to 98 per cent. arsenious acid)	2 oz.
Epsom salts	6 lb.
Water	5 gallons.

Boil the arsenic for half an hour in 2 gallons of water. Allow the sediment to settle, then pour off and retain the clear fluid. Add the Epsom salts and make up to 5 gallons.

ROUNDWORMS.

Of the numerous species of roundworms that occur in cattle many are inconspicuous and of little importance, and have been omitted from these notes. Others, while producing no outstanding symptoms of infestation, are included owing to their comparatively frequent occurrence.

THE LARGE STOMACH WORM (Haemonchus contortus).

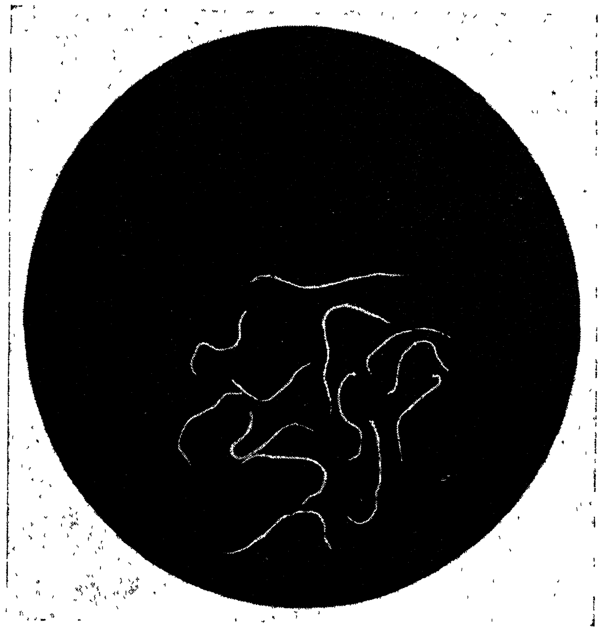


PLATE 290.—THE LARGE STOMACH WORM (*Hæmonchus contortus*).

The large stomach worm is found in the fourth stomach, and not only occurs in cattle but also in sheep and goats. Of the two sexes the female is more conspicuous, being red and white striped and about an inch in length. The male is smaller and uniformly pinkish or whitish.

Life History.

The eggs laid by the female worm eventually reach the exterior in the dung. Under favourable conditions these hatch and give rise to tiny larvæ. These larvæ feed and develop in the dung and in a few days reach the infective stage, the larva now being completely enclosed in a sheath, which helps to protect it against adverse conditions. Crawling up the grass blades, when moisture is present, the larvæ are taken in by the animal when grazing. Making their way to the fourth stomach they settle down and grow to maturity.

Effect of Infestation.

Only calves and young cattle appear to be affected by the large stomach worm. A heavy infestation causes continuous diarrhœa, anæmia, and emaciation, and also may manifest itself in a large swelling beneath the jaw (bottle jaw), and unless treated the animal may die.

Treatment and Control.

Bluestone will be found a satisfactory drench for the large stomach worm. This is made up as follows:—Bluestone (fresh), 8 oz.; water, 3 gallons.

If desired, 8 oz. of mustard may be included. The bluestone should be dissolved in the water in an enamel or earthernware vessel. The mustard is mixed to a smooth paste and then added to the bluestone solution, keeping the mixture well stirred whilst using. The animals to be treated should be starved for twenty-four hours before and for four hours after treatment, the dosages being as follows:—Calves four months, 3 oz.; calves six months, 4 oz.; calves nine months, 6 oz.; calves twelve months, 8 oz.

This treatment should be repeated at least once after a fourteen days' interval.

In addition to treatment preventive measures should be adopted, the most important of which are—

1. The avoidance of paddocks of a marshy nature as calf pastures.
2. The burning off of the pastures when possible, such burnt off areas to be used only by the calves.
3. Losses due to stomach worm infestation occur mainly in the late winter and early spring; that is, at a time when the pastures contain very little nourishment. It is believed that the use of supplementary foods during this period, especially to "poddies," would considerably increase the resistance of the animal to the effects of infestation. A good bonemeal lick should always be available to the animals as well.

THE LESSER STOMACH WORM (Ostertagia ostertagi).

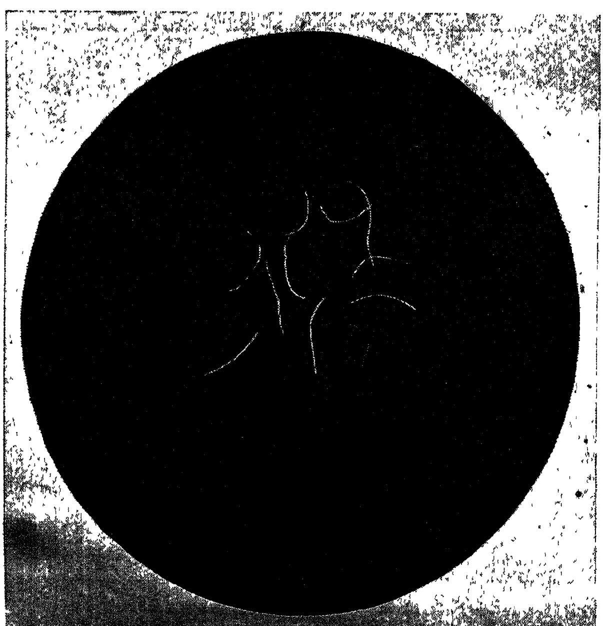


PLATE 291.—THE LESSER STOMACH WORM (*Ostertagia ostertagi*).

This is a slender brownish worm found buried in the mucosa of the fourth stomach. Although one of the commonest parasites of cattle in Queensland it is not considered to be of any importance. The life history differs only in detail from that of the large stomach worm.

THE CATTLE HOOKWORM (Bunostomum phlebotomum).

PLATE 292.—THE CATTLE HOOKWORM (*Bunostomum phlebotomum*).

This is a conspicuous whitish species about half an inch to nearly an inch in length occurring in the first portion of the small intestine. The mouth of the hookworm is provided with teeth with which it attacks the intestine wall.

Life History.

The eggs laid by the females are passed out in the dung. After hatching the larva develops into the infective stage when it is enclosed in a sheath. Should these infective larvæ come into contact with the skin of the host, they immediately bore through it and reaching the blood vessels are carried to the lungs. After developing in the lungs for some time they move out into the windpipe or trachea and from here to the mouth. They are then swallowed, and reaching the intestine settle down and grow to maturity.

Infective larvæ may also be taken in with food. They then bore through the wall of the alimentary canal and reaching the blood stream are carried to the lungs, returning later on to the intestine via the mouth.

Effect of Infestation.

The cattle hookworm is a not uncommon parasite in Queensland and probably is concerned to a certain extent in the general unthriftiness of calves in many coastal areas. The species is responsible for a

considerable loss of blood, and in other countries where it is found is regarded as a very serious parasite, causing symptoms very similar to those already outlined for the large stomach worm.

Treatment and Control.

No tests so far as is known have yet been made with drugs for the removal of the cattle hookworm. Of the many drugs available tetrachlorethylene seems to be the most promising as well as being fairly safe. Doses of 10 cubic centimetres to 30 cubic centimetres are advised. These dosages, to be as safe as possible, should be followed by a purgative (Epsom salts).

The preventive measures outlined for the large stomach worm should also be enforced as far as practicable.

THE LARGE BOWEL WORM (Oesophagostomum radiatum).

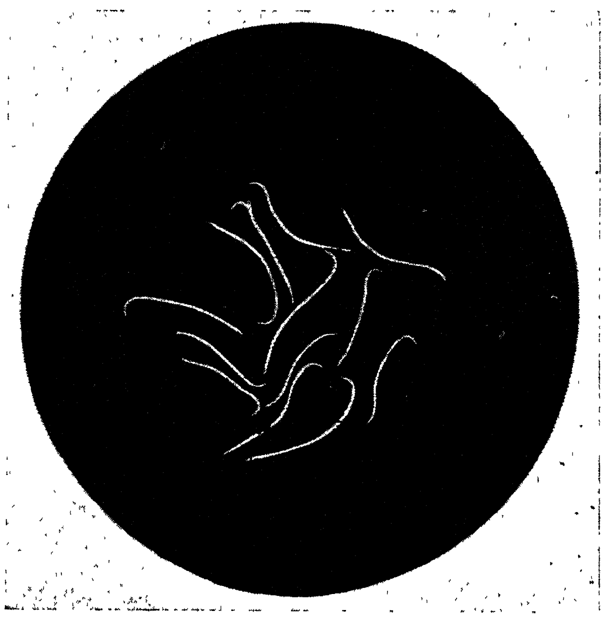


PLATE 293.—THE LARGE BOWEL WORM (*Oesophagostomum radiatum*).

Description and Life History.

This species is a whitish worm up to ¾ inch in length inhabiting the large bowel. The life history is very similar to that of the large stomach worm, but in this case the infective larvæ after being taken in by the animal when grazing make their way into the intestines and burrow into the intestine wall. This results in the formation of a small nodule in which the young worm spends portion of its life. Its development in the nodule being completed, the worm then makes its way into the large bowel where it spends the remainder of its existence.

This species is a very common parasite of cattle, and when in numbers is considered to cause unthriftiness, especially in calves.

Control.

There is no treatment available for the removal of the large bowel worm, and the preventive measures advised for the control of the large stomach worm should be practised.

THE LUNG WORM (Dictyocaulus viviparus).

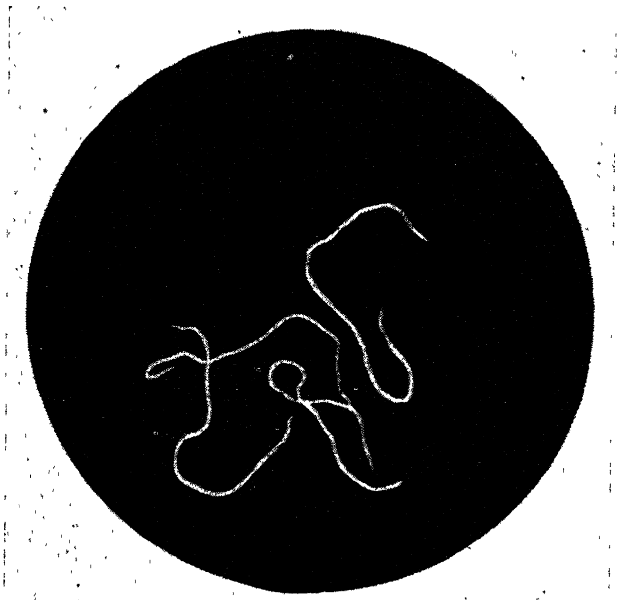


PLATE 294.—THE LUNG WORM (*Dictyocaulus viviparus*).

The lungworm is an elongate slender worm occurring in the air tubes of the lungs. The females may grow up to 3 inches or more in length. The males are smaller and measure 1½ to 2 inches long.

Life History.

The eggs when laid by the female worm contain fully developed embryos and hatch in the lungs. The young larvæ may travel into the mouth, be swallowed, and reach the exterior in the dung, or they may be coughed out in the bronchial secretions.

After a period of development outside the animal they reach the infective stage. They are then taken in by the animal in food or water. Boring through the intestine wall they eventually reach the lungs either in the blood or lymph streams. Once in the lungs the larvæ make their way to the air tubes, where they become mature.

Symptoms of Infestation.

Lungworms are serious among calves and young cattle only. In light infestations no symptoms are observed. When the worms are numerous the calf develops a husky cough. The bunches of worms in the air tubes may interfere with breathing and the animal may exhibit symptoms of suffocation. Large amounts of mucous, sometimes

blood-streaked, may be expelled, and in which bunches of worms may occur.

Treatment and Control.

The following measures, if adopted carefully, should control any outbreak of this parasite:—

1. As the free living stages are favoured by paddocks of a marshy nature, all animals in such paddocks should be removed to high and dry country, and a safe supply of drinking water provided if possible by using troughing.
2. As stomach worms are usually found under the same conditions as lungworms, a bluestone drench by removing any stomach worms will assist the calf to resist the lung worms. This drench consists of 3 to 8 oz. of a solution of ½ lb. of bluestone (fresh) in 3 gallons of water following overnight starvation.
3. Infested animals should have good nutritious food. The greatest factor in treating an infested calf is good nursing.
4. In severe infestations an intertracheal injection of the following formula will be found beneficial, especially if repeated after one week. The injection is made with a sterilised hypodermic syringe between the cartilaginous rings of the windpipe:—Turpentine, 1 drachm; carbolic acid, 10 minims; chloroform, ½ drachm; glycerine, 1 drachm.

THE BEEF NODULE WORM (Onchocerca gibsoni).

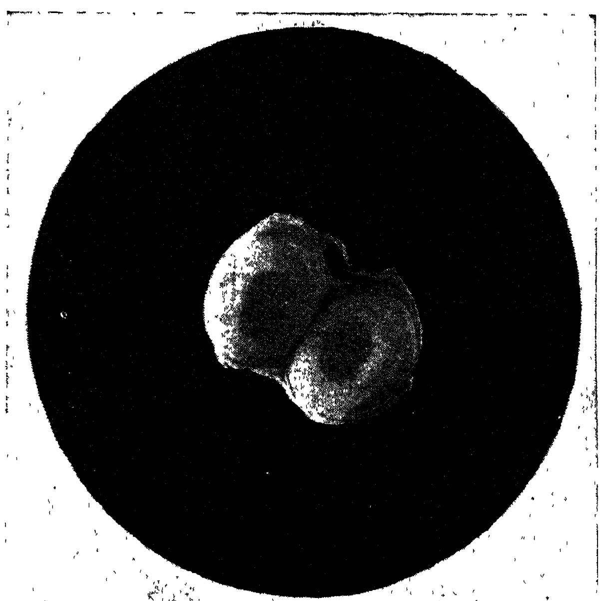


PLATE 295.—THE BEEF NODULE WORM (*Onchocerca gibsoni*).

This parasite takes the form of nodules, varying somewhat in shape and size, which occur in the brisket and stifle joint. These

nodules are generally rounded and may measure up to 4 inches in diameter. In the centre of the nodules or worm nests there lies a long threadlike female worm 20 to 56 inches long, with which may be associated one or more males $1\frac{1}{2}$ to 2 inches long.

The nodule itself is constituted of fibrous tissue and is formed by the host tissues as a reaction to the presence of the parasite. Eventually the worms die and undergo calcifiation but the nodule remains.

Effect of Infestation.

The beef nodule worm is exceedingly common and is found in cattle of all ages excepting young calves. The worm does not appear to be harmful in any way to the animals themselves, but as nodule-infested briskets are not permitted entry into the United Kingdom, the loss to the beef industry through the removal of this portion of the carcase is very heavy.

Control.

No control measures for this parasite can be recommended until its life history is known. Other worm parasites closely related to the nodule worm require an intermediate host to complete their life cycle, and in several cases species of "sandflies" fill this roll.

PLATE 296.—SECTION OF BEEF CARCASS COMPETITION, BRISBANE ABATTOIR.

[*Block by courtesy Queensland Meat Industry Board.*

The Wireworm Pest and its Control in Central Queensland Sugar-cane Fields.

By W. A. McDOUGALL, Assistant Entomologist.

LARVÆ of certain genera of the Elateridæ or "Click Beetles," commonly known as wireworms, are capable of causing great damage to cultivated crops, and for a considerable number of years it has been recognised that wireworms are responsible for damage to sugar-cane in certain parts of Queensland. Jarvis (1927 *b*) stated that in 1910 wireworms had been observed to inflict serious damage to young cane planted on alluvial flats at Mackay, and that in the same year this pest occurred freely in Isis Central district, where it was reported to be causing more damage to cane than was being done by any other insect. This writer further (1925 and 1927 *a*) listed a number of possible wireworm control measures. Illingworth (1919) mentioned that there was evidence of wireworm damage in the Mossman district. During the period 1924-30 officers of the Bureau of Sugar Experiment Stations published various reports embodying some field observations, locality records, and recommendations for the control of these pests. Cottrell-Dormer (1924 *b* and *c*) reported damage in low-lying country at Mooliba (near Babinda) and in the Homebush and Eton districts, near Mackay. Writing of wireworms in the Mackay district (1924 *a*) he stated that they do damage mostly during the colder months of the year; it was claimed by some farmers that such damage was worst following a planting of cowpea as a green manure crop. Mungomery (1926) found wireworms attacking cane in the Pialba district, particularly after spring planting, and Bates (1925) reported *Monocrepidius* sp. attacking eyes of setts at Strathdickie and Tawvale, Proserpine mill area, during July and August. In 1928 the attention of Burns (1928 *a*), then Assistant Entomologist at the Mackay Experiment Station, was drawn to a serious wireworm infestation at Te Kowai. Plants were bored into at the ends, and the wireworms were observed to be voracious feeders capable of rapid movement through the soil. Burns (1928 *b*) observed several species* of wireworms in Mackay canefields, and in his annual report for 1929 mention was made of several large infestations at Walkerston, Te Kowai, Farleigh, Habana, and Racecourse. Following further and more serious damage in this area, a rapid survey was carried out by Mungomery, who reported to the Director (1930) that damage appeared to be most severe in low-lying, poorly-drained land which remained wet and cold. The life cycle of the pest was thought to be at least a year or more, and the period of oviposition of the adults a very protracted one.

Although much had been written about wireworms damaging cane in Queensland and their possible control, no serious attempt had been made to investigate the problem thoroughly prior to 1931. In that

* Specimens at the Mackay Experiment Station labelled by Burns as "Wireworms ex canefields 1928" have been identified as J. sp. *Lacon assus* and *L. variabilis*. All those found damaging cane are of the lastmentioned species.

Fig. 1. A field of four acres completely destroyed by wireworms; note an occasional shoot and damaged plants which had been removed when supplying. This was the first planting since about 1917, when a similar strike failure occurred. Swamp country, Sandiford, July, 1933. (Photo. by W. C. Dormer.)

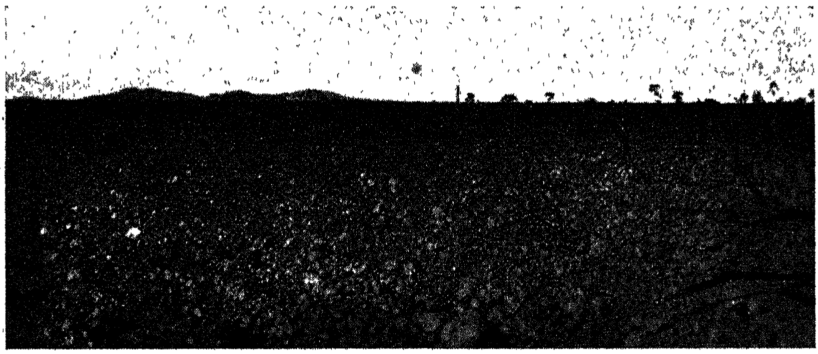


Fig. 2. Poor stand of cane in a low corner of the field; the eyes have been destroyed by wireworms. The planting of this corner always results in a poor strike. Walkerston, 1931.

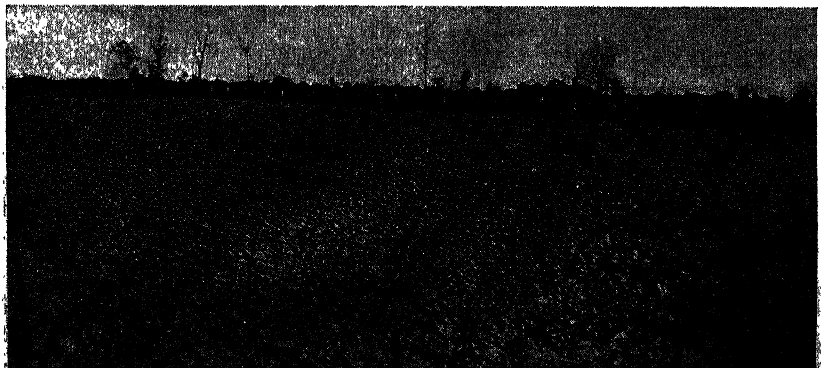


Fig. 3. A poor stand of cane in a badly drained lower end of a field. The eyes have been destroyed by wireworms. Walkerston, 1931.

Plate 297.

year the investigation of the wireworm problem in the Mackay and Proserpine mill areas was made a major project, since in these areas, more so than in any other Queensland cane district, wireworms are, at times, a serious pest. Certain portions of the work carried out by the writer have already been published—McDougall (1934).

Nature of Wireworm Damage and its Economic Importance.

The wireworm larvæ attack the swollen eyes of cane setts, young shoots, or the underground portions of larger shoots. The damage consists in the eating of only a small tunnel which cuts across the centre of the growing point, thus bringing about the death of the shoot or bud; in some cases a considerable portion of the interior of the buds may be eaten. Examples of damage to growing shoots may be seen in Plate 300, fig. 1. When wireworms are found in the act of eating into buds or shoots, it will be noticed that as a rule a considerable portion of the posterior half of the larva is protruding from the tunnel. In contrast to this mode of attack, the larva of the large moth borer (*Phragmatiphila truncata* Walker) enters a shoot by a small hole, and completely houses itself by eating out the centre for some distance above and/or below the entrance hole level (*see* Plate 300, fig. 2).

When all the eyes and small shoots of a set are attacked no stool results, while when larger shoots are attacked the effect is to produce "dead-hearts" in the primary shoots, the formation of the stool then depending on the formation of secondary shoots. On rare occasions the secondary shoots—in fact, all shoots as they arise—may be destroyed by the pests. The effect of wireworm attack on shoots and eyes may thus result in practically a complete failure of germination throughout the field (Plate 297, fig. 1.) Such complete failures are unusual, however, and as a rule the misses are lightly or heavily distributed throughout the block or are confined to small or large patches or to the lower ends of fields (*see* Plate 297, figs. 2 and 3; Plate 298, figs. 1, 2, and 3).

Damage in the Mackay district is almost exclusively confined to low, badly-drained land. During the past fifteen years considerable areas of this type of country have been planted to cane in the Mackay and Proserpine mill districts, and this has been responsible for the appreciably increased proportion of damaged strikes caused by wireworms. Taking the districts as a whole this proportion is not high, and the majority of the farmers are not troubled by wireworms except, possibly, in an occasional low spot in which a poor strike is considered by many of the farmers to be of little consequence. This fact points to one of the most serious aspects of wireworm damage. If the total damage were more evenly distributed, losses would not be so disturbing, but, unfortunately, there is a small percentage of farms which contain quite appreciable areas of wireworm infested country, and here this pest is most serious.

Losses caused by wireworm depredations consist in the decrease in plant and subsequent ratoon tonnages, and an increase in production costs per ton of all cane harvested in wireworm infested fields. This increased cost may be due to the irregular distribution of the stools in the fields, supplying misses (often two or three times) or even replanting,

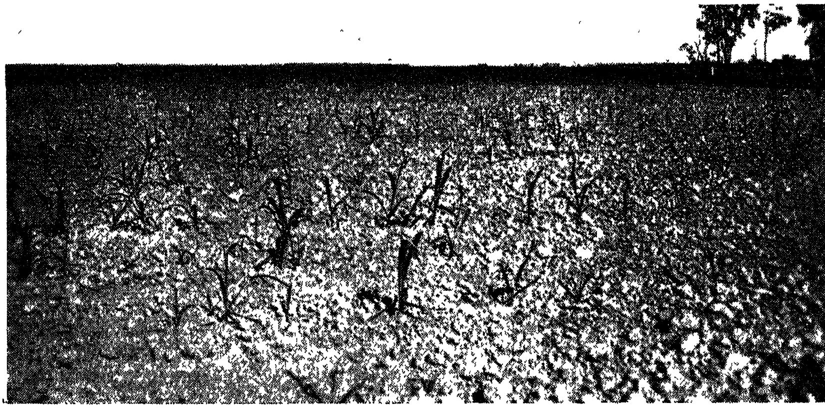


Fig. 1. A poor stand of cane on a badly drained lower end of a field. The eyes and young shoots have been destroyed by wireworms. Walkerston, 1931.

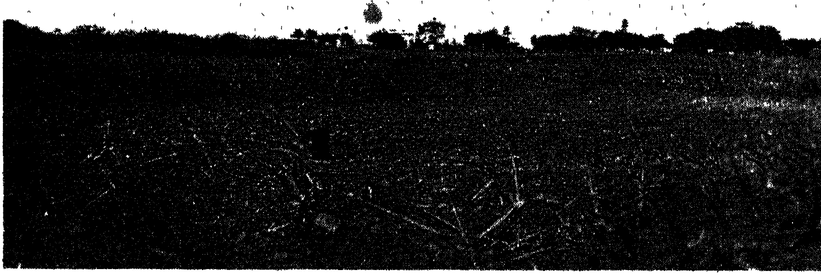


Fig. 2. A complete strike failure in a very badly drained depression. The eyes have been destroyed by wireworms. The Lagoons, Mackay, 1932.

Fig. 3. A poor stand of early plant cane in a badly drained depression in the centre of the field. The eyes and young shoots have been destroyed by wireworms. Te Kowai, July, 1933. When planted in 1928 a similar bad strike was obtained. (Photo. by W. C. Dormer.)

PLATE 298.

the initial cost of preparing parts of fields which do not yield any returns whatsoever, wasted fertilizer, increased cultivation costs due to the greater weed growth where poor stands occur, or the cost of some unsuccessful methods of wireworm control which may have been tried after the presence of the pests had become evident in the fields. Ratoon crops do not suffer damage from direct wireworm attack.

The Pest Species.

Jarvis (1927 *b*) stated that he had reared *Monocrepidius* adults from larvæ found in the soil about cane roots in the Bundaberg district, and until 1930 this seems to have been, with one exception,* the only rearing work done with wireworm pests from Queensland canefields. It would seem to have been the custom in the past, if naming the pests at all, to refer any wireworms damaging cane anywhere in Queensland to the genus *Monocrepidius*. The first departures from this custom were when Mungomery (1928) stated that *Lacon variabilis* and many *Monocrepidius* species damaged cane in Southern Queensland and when the same author (1930) considered that apparently one species, a *Lacon* species, was responsible for nearly all the wireworm damage reported from the Mackay and Proserpine districts.

During the three years 1931-33 the following Elaterid larvæ were collected at different times from Central Queensland cane fields: *Lacon lateralis* Schw., *Lacon variabilis* Cand., *Lacon assus* Cand., *Lacon humilis* Er., *Heteroderes carinatus* Blbn., *Heteroderes cairnsensis* Blbn., *Agrypnus mastersi* Macl., and several other species whose adults are either not known, or, if known, are unidentified. Included in the last group is *Lacon* "Q" sp. It was found that very nearly all wireworm damage observed during the above period was due to *L. variabilis*.

Specimens of the wireworms found by Mungomery to be damaging cane in the Mackay district were examined and identified as *L. variabilis*.

It has been established that wireworms have been pests in some particular fields in the Mackay district since as early as 1890, and examinations of the damaged areas in these fields during a planting in 1931, 1932, or 1933, showed the pest to be *L. variabilis*. Inspections of damaged areas proved to be those referred to in some of the literature as localities of damage by *Monocrepidius* spp., have shown the pest in these localities to be *L. variabilis*. It seems evident that this species is and has always been the wireworm pest in the Mackay and Proserpine cane fields. Consequently in this paper unless otherwise stated, all discussion will refer to *L. variabilis* and further references to other species of wireworms found in Central Queensland cane fields will be made only when they may be of help in the identification of the various stages of *variabilis* in the field and in the formulating of a control for this pest.

Description of L. variabilis.

The Adult.—The adult "click-beetle" is a uniform dark-brown colour on both upper and lower surfaces. It is moderately flat in shape and shows a considerable variation in size ranging from one-third to one-half inch in length, with a width of about one-fifth inch. The elytra or wing covers appear as possessing a series of parallel ridges which run lengthwise.

* Mungomery (1927) listed *L. variabilis* amongst the insects reared by him during that year from larvæ to imagines.

The following descriptive information concerning the genus *Lacon* is derived from Elston (1924) :—

> "The mandibles are bifid or dentate on the inside. The apical segment of the palp is securiform. The antennæ are short: the first segment is large and somewhat bent, the second and third small, the third somewhat shorter than the second, the following are triagular, the last at the apex truncate or emarginate. The elytra are usually punctate-triate or with seriate punctures, the shoulders either rounded or angular, and the epipleuræ more than twice as long as wide. The antennal furrows on the prosternum reach only to the middle. The insects of the genus may be divided into four sections according to the presence or absence of well-defined tarsal furrows on the pro- and metasternum. One section is represented by *L. variabilis*, which is without tarsal furrows on the meta- and prosternum, or, if present on the latter, are so ill-defined as to be almost indiscernible."

Elston found that as the name *variabilis* implies, the species is very variable.

> "On some specimens, particularly with the male, the tarsal depression is more or less visible, whilst on others it is entirely absent; the sculpture of the elytra also shows a certain amount of variability, the alternate interstices being more conspicuously elevated on some species than on others."

There is found to be very little variation in the elytral structure of adults reared from larvæ attacking cane or in adults collected in the Mackay and Proserpine canefields. On examining an elytron it will be found that, excluding the lateral ones, the alternate interstices, which are wider and have three rows of hairs instead of two (Plate 303, fig. 4) are nearly always sufficiently elevated to give a general macroscopic appearance of a distinct series of parallel ridges. In specimens from Rockhampton and in a very occasional one collected in Mackay canefields, the alternate interstices are not as conspicuously elevated as in the vast majority of Mackay specimens.

Detailed measurements, in millimetres, of the largest and smallest specimens collected over three years in Central Queensland canefields, are as follows:—

——	Total Length.	Thorax.		After-body.	
		Length.	Width.	Length.	Width.
Largest specimen	14·5	3·9	4·4	9·7	4·7
Smallest specimen ..	8·7	2·4	2·7	5·7	2·8

The Egg.—The egg is opaque to pearly-white in colour, ellipto-cylindrical in shape, and the ends are broadly rounded and similar. From the measurement of one hundred eggs it is evident that there is little variation in size; the length always approximates very closely to ·58 mm. and the width to ·47 mm., i.e., if placed lengthwise there would be about forty-three eggs to the inch. Under a magnification of 80x the chorion is seen to be quite smooth, and that it is tough is shown by the fact that the eggs are easily handled without any changes in their shape, and that during a considerable period after the hatching of the small larvæ it is difficult to separate the shells from the full eggs.

The Larva.—The active larva or "wireworm" is a worm-like segmented creature, semi-flattened in shape, and, when full-grown, is usually about four-fifths of an inch in length and with a greatest width

of approximately one-eighth of an inch. In general appearance it is pale waxy-yellow with the "head" and forked part of the end segment reddish-brown. The short legs are armed with short brown spines. In the field the larvæ may be recognised by the shape of its end segment as in Plate 299, fig. 2B, and Plate 304.

The greater part of the dorsal and ventral surfaces is pale waxy yellow with the narrower lateral areas a lighter shade. With the exception of the nasale and mandibles, which are very dark brown to black, the head and the pronotum are reddish-brown. The four prongs of the two terminal processes and the five tooth-like structures on each lateral margin of the flattened dorsal portion of the ninth abdominal segment are dark reddish-brown. The spiracles are not conspicuous. The nasale is tridentate, the processes being of equal lengths (Plate 303). The "pseudopodium" (anal segment) is armed with a strong ascending hook (Plate 304). There is one conspicuous variation in larval setation; conspicuous because it concerns the flattened dorsal surface of the ninth abdominal segment. There, the presence of two tuberculate hairs situated at about the beginning of the distal third is constant. Midway between these two hairs and the anterior margin two smaller hairs will be noticed in Plate 299, fig. 2B. In this position as many as five hairs may be present, or none at all.

The following is an example of a detailed measurement, in millimetres, of a full grown mobile larva:—Total length, 20.0; head capsule, length 2.0, width 2.0; prothorax, length 2.0, anterior width 2.1, posterior width 2.5; other two thoracic segments, length of each 1.0, width of each 2.8; length of each of first eight abdominal segments 1.4, width of first 3.0, width of fifth 3.2, width of eighth 2.9; ninth abdominal segment, length 2.4, greatest width 1.9.

The Pupa.—When first formed the pupa is opaque white and, except that the abdomen is slightly longer, very much resembles the adult beetle into which it will change in both shape and size.

The pupa is microscopically spinose. There are two fleshy thorn-like structures or spines on the anterior border of the prothorax above the eye spots. These point upwards, whereas similar ones on the lateral angles of the much broadened posterior angles point upwards and outwards. The spines in the angles formed by the dorsal median line and the posterior border of the prothorax are very small. The bifid nature of the adult mandible is early discernible in the pupa. The antennæ, of similar form to those of the adult, lie along the margin of the thorax on the ventral side and reach to the posterior angles. There are nine abdominal segments. The ninth terminates dorsally in two closely placed fleshy spines covered with brown barbs. At the base of each spine there is a much smaller spine. During early life the wing cases reach on to one quarter of the venter of the fourth abdominal segment and the third pair of legs on to one quarter of the fifth. Later—i.e., during the last four days of pupal life—there are considerable visible alterations, including a darkening in colour; the tips of the mandibles are plainly visible as also are the antennal and tarsal segments. The edges of the antennal furrows become pencilled in brown, and the relative position of tips of the wing cases, the posterior legs, and the abdominal segments change very appreciably. The contents of the eighth and ninth abdominal segments retreat into the adjacent segments leaving an empty case. The shape of the seventh abdominal sternum of the pupæ is very similar to that of the seventh body segment (actually the fifth visible) of the adult. In the pupæ all the abdominal terga and sterna can be seen.

Distribution.

According to Elston (1924) *L. variabilis* is commonly distributed over the whole of Australia and Tasmania. However, with the exception of the records of damage to cane in Central and Southern Queensland it has not otherwise been recorded as a pest. With the exception of five adult specimens labelled "Rockhampton" in the Queensland Museum, a few adults collected in the Bundaberg district, and specimens that had been received from Mackay during the past four years, no adults or

larvæ of this species could be found in any of the Queensland collections of Coleoptera examined. These included those of the Queensland Museum, Department of Agriculture and Stock, at Brisbane, the University of Queensland, and of the Sugar Experiment Stations at Meringa and Bundaberg. Wireworms found by Mr. Mungomery, during the past year, to be damaging cane in the Bundaberg district were reared to adults at Mackay and other specimens collected in the past from southern canefields were examined; none of these is *L. variabilis.* However, Mr. Mungomery has informed the writer that *L. variabilis* larvæ have been found actually damaging cane setts in the Pialba district; this occurrence is responsible for the recording of this species as a pest of cane in Southern Queensland.

In 1931 two species of wireworms reported to be damaging cane setts at Mossman, North Queensland, were forwarded to the writer for examination. The smaller species, one of the cylindrical type of Elaterid larva, was considered by the observer to be the more serious pest; what proved to be the adult of this species could be found in the cane in circumstances similar to those mentioned by Illingworth (1919). The two specimens of the second species could not be distinguished from the sixth larval instar of *L. variabilis.* Moreover, it seems that wireworm infestations in the Mossman district occur under conditions similar in many respects to those concerned with the habits of and damage by *L. variabilis* in the Central Queensland fields.

Other Insects which may be mistaken for Lacon variabilis.

There is but one commonly seen Elaterid adult or "click-beetle" in the Mackay and Proserpine districts which more or less closely resembles *L. variabilis* (*see* Plate 299, fig. 1). This is *Lacon humilis* Er. As will be noticed in Table II. (page 703), *L. humilis* is attracted by light, whilst *L. variabilis* is not. *L. humilis* is darker in colour than *L. variabilis* and there are no apparent ridges on the wing covers.

(When the central portion of an elytron of *L. humilis* is examined it will be seen that the interstices are all of similar width; the clothing is similarly arranged on each, and there is no outstanding elevation of any of them (see Plate 303).)

Dystalica mackayensis Carter (Plate 303) is very plentiful and noticeable in Central Queensland canefields. If wireworm damage is particularly heavy in any field or district, farmers often form the opinion that this beetle is the adult of the wireworm. *D. mackayensis* is not a "click-beetle," being a member of the family Tenebrionidæ and its larvæ are quite harmless to cane.

In the larval or wireworm stage many different Elaterid species, which may have quite different habits, very closely resemble one another, but so far as those in Central Queensland canefields are concerned, it is necessary that the differences between two species only be known. These are *Lacon variabilis* (the lowland wireworm) and *Heteroderes carinatus* (the highland wireworm). They are very similar in colouring and general shape, but in the field they may be distinguished by the differences in the shapes of their end segments as shown in Plate 299, fig. 2, and Plate 304.

(The nasale of *H. carinatus* is pentadentate, the processes being of equal length (Plate 303). There is no strong hook on the pseudopodium (Plate 304).)

Heteroderes carinatus, although quite plentiful in well-drained fields in the Mackay district, has never been known to seriously damage cane.

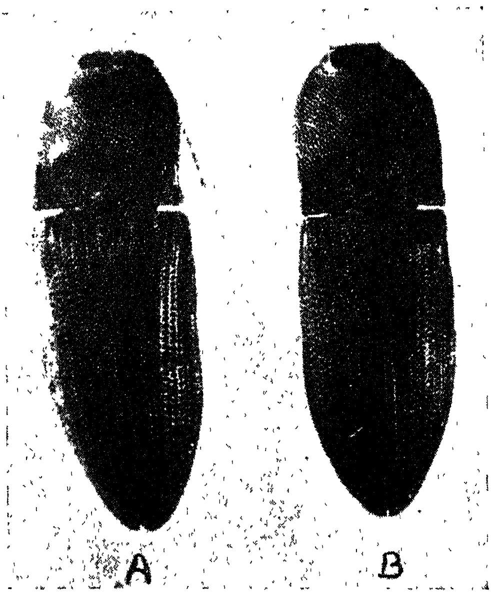


Fig. 1. Adults of A: *Lacon variabilis* Candige, x 5. B: *Lacon humilis* Er. x 5.

Fig. 2. Dorsal views of full-grown larvæ of A: *Heteroderes carinatus* Blackburn, x 4. B: *Lacon variabilis* Candige, x 4.

PLATE 299.

The carnivorous larvæ of the carab, *Gnathaphanus pulcher* Dej., is generally distributed in many fields and may be present in large numbers in some situations. With its brown head and very pale-yellow to white abdomen it is sometimes mistaken for a wireworm, but it should be easily distinguished from any of the latter by the greater size of its head in proportion to its body, the much softer abdomen, and the presence of two spine-like strucutres (urogomphi) near its posterior end.

The three false wireworms most common in Mackay and Proserpine canefields are the larvæ of the Tenebrionid, *Dystalica mackayensis,* and of the Cistelids, *Hybrenia elongata* Macl. and *Dimorphochilus pascoei* Macl. The latter two when seen in the field are much larger than most of the local semi-flattened wireworms. All resemble the cylindrical type of wireworms (none of which damage cane in ploughable canefields in Central Queensland) more than the semi-flattened type of which *L. variabilis* is a member. The false wireworms possesses a distinct lamrum whereas wireworms and other Elaterid larvæ do not.

Insect Damage which resembles that caused by Wireworms to Cane.

In Central Queensland cane areas there are three insects that may cause damage to cane which superficially resemble that caused by wireworms. These are a small black beetle *Pentodon australis* Blbn.* (Plate 300), the caterpillar of the large moth borer (*Phragmatiphila truncata* Walker), and small white grubs of *Rhyparida* species. Of these *Pentodon australis* is of the most importance, and like the wireworm it causes "dead-hearts" in growing shoots and eats the eyes of setts. This damage may be effected in either high or low land, and damage by Pentodon in high land in which larvæ of *H. carinatus* have been observed, is often debited to wireworms.

When a wireworm attacks a shoot the hole is surrounded by small amounts of fibrous material (Plate 300, fig. 1). On the other hand the Pentodon beetle, which is larger than the wireworm and a much grosser feeder, in its attack on the underground portions of the shoots, makes much larger holes, at the edges of which are considerable masses of frayed fibrous material (Plate 300, fig. 3)—a beetle in the act of feeding is shown on the extreme right). When the Pentodon beetle attacks the eye of a sett it does not tunnel to the centre but gouges it out completely. Damage to strikes by the larvæ or grubs of the Pentodon beetle is more common in early than in late plantings; these grubs chiefly damage eyes and setts by eating out large cavities.

Plate 300, fig. 2, shows the small, neat holes in shoots caused by the large moth borer. This insect does not attack eyes of setts. Attacks by *Rhyparidu* spp., although sometimes severe, are comparatively rare.

Habits and Characteristics of Lacon variabilis.

Few eggs or first-stage larvæ have been seen in the field. Washing and sieving (after Shirck (1930)) of soil samples from localities where

* According to C. E. Chadwick, Eltham, N.S.W. (in a communication dated 25th July, 1933) this species was described by Olliff under the name *Heteronychus vulgivagus,* and in the South Australian Museum collection all specimens of this species, including a cotype of *Pentodon australis* Blbn., stand under the name *Meanastes vulgivagus* Olliff. The name *P. australis* is used in this publication for the reasons: (*a*) up to the present no published accounts of the synonymy of this species have been found; (*b*) for many years the insect has been widely known under this name to cane farmers in Queensland and New South Wales.

Fig. 1. Wireworm damage. Note that tunnel does not extend beyond the centre of the shoot nor above or below the growing point.

Fig. 2. Underground portion of cane shoots attacked by *Phragmatiphila truncata* Walker.

Fig. 3. Underground portions of cane shoots damaged by *Heteronychus arator* F.

PLATE 300.

adults were known to have been present four or five weeks prior to the date of sampling, gave very poor yields. In the laboratory, gravid female adults, caged under conditions made to resemble as nearly as possible those which would most likely be encountered by them in the field, usually deposit eggs either singly on the soil surface or in batches in crevices at a depth not exceeding two inches. The eggs are not covered by any secretion, and when laid in batches are not connected in any way. No egg chambers are constructed. Observed first batches of eggs deposited by an adult have contained from two to seventeen eggs, but usually ten to fifteen, while later batches deposited by the same adult have consisted of as many as twenty-three eggs or as few as two. Table I. is a sample of a series of the recorded observations on the number of eggs deposited (and dates of deposition) by thirteen beetles during the 1931-32 summer, and twenty-three beetles during the summer of 1932-33. The maximum number of eggs deposited by any one female was thirty-six, the minimum two, and the mean for the thirty-six beetles was twenty-three.

TABLE I.

EGG DEPOSITION AS RECORDED FROM OBSERVATIONS ON 36 CAGED FEMALES.

Lab. No. of Female.	Number of Eggs Deposited.	Date of Deposition.	Remarks.
A 1 .. (confined with 2♀♀)	15 11	8–1–32 3–2–33	On 24–2–32 female still alive; dissection showed 65 well-developed eggs in egg-tubes
A 2 .. (with 2♀♀)	13 23	10–1–32 28–1–32	On 24–2–32 female still alive; dissection showed 59 well-developed eggs in egg-tubes
A 7 .. (with 1♀)	4 7 15	3–12–31 1–2–32 3–2–32	
A 5 .. (with 3♀♀)	10 2	20–11–32 5–12–32	All females alive on 29–3–33 with well-developed eggs in egg-tubes
A 8 .. (with 1♀)	12 19	9–12–32 18–12–32	
A 9 .. (with 4♀♀)	12 10	7–12–32 16–12–32	

The eggs have withstood immersion in water for a period as long as five days, and young have hatched out from eggs exposed to a soil environment ranging from moderately dry to free water present. The young larvæ emerge from the eggs through small holes eaten in the shells. Dispersion through the upper two or three inches of soil quickly follows and, at this stage in larval life, feeding largely consists in the ingestion of soil. The average length of the newly-hatched larvæ is 2·1 mm. and the width ·27 mm., the widest parts being the head capsule and the prothorax. Towards the end of the first larval stadium the length may be as great as 3·38 mm. and the width ·43 mm., the abdominal segments being then the widest parts.

During a moult the skin usually splits along the median dorsal line of the thorax only; sometimes the head capsule and the anterior abdominal segments are included in the splitting. The thoracic segments first emerge through the split and are followed by the head and abdomen. The pulling of the abdomen through the unsplit portion of the moulted skin or exuvium causes a certain amount of telescoping of the exuvial segments; the result is that the moulted skin appears as a distinct head capsule and a distinct ninth abdominal segment connected by a mass of telescoped intermediate segments. An exuvium of this type* is comparatively compact and does not break up very quickly in loose soil; such exuviæ from the larger instars are often found complete in the field.

After a number of ecdyses, or moults, pupation takes place in earthen cells at a soil depth which depends upon the disposition of the moisture in the soil at the time when the mobile larvæ assume a torpid prepupal state. This change of state invariably takes place in the top two inches of visibly moist soil. If the weather has been showery the pupæ will be found within an inch of the soil surface, whilst following dry times, pupæ have been collected at soil depths as great as seven inches.

Adults are seldom seen in the field unless special search is made for them in suitable localities at certain times of the year. After light showers of as little as ten points, or after heavy rains in November or December, they may be found in their greatest numbers behind the lower leaf sheaths of cane growing in depressions or in any other low-lying part of a canefield where wireworm damage was evident during germination. In these low-lying areas adults may also be found under clods, at the base of grass clumps, or under any debris which may be present. Often adults of other Elaterid species and false wireworms will be found along with *L. variabilis*. Under one small plant in November, 1931, there were found as adults, nineteen individuals of *L. variabilis,* three of *L. assus,* numerous *H. cairnsensis,* and many *Dystalica mackayensis* Carter, together with larvæ and a few pupæ of the last-mentioned. Occasionally as many as fifteen *L. variabilis* adults have been collected from behind one leaf sheath, but usually not more than five will be so found. When disturbed the beetles drop and remain inert for some time. Structurally they are capable of strong flight but are seldom seen in flight. During three years' observations less than twenty adults have been seen in the field other than under the various previously-mentioned covers. These observations were made during all hours from 4 a.m. to 12 p.m. After suitable rains on one occasion, fifteen adults were taken after flight from cane leaves at 9 p.m.; fairly heavy rain had been experienced during the day.

Migration and Initial Infestation of Fields.

There seems to be no doubt that the adults will in time migrate from their native habitat (i.e., swampy grass lands), and slowly invade

* During ecdyses of the cylindrical type of wireworm, and of the Tenebrionoid larvæ studied, the splitting of the skin along the mid-dorsal line is not confined to the thorax but is continued along the first seven or eight abdominal segments as well. Exuviæ of these larvæ quickly fall to pieces.

any part of a field where structural work such as the building of a railway, road, or tramline, or other cause has made the drainage insufficient. It appears, however, that migration of adults from one locality to another in badly-drained cultivated country is even slower, but once the species is present in a cultivated fields its population density may increase. This is in marked contrast to the behaviour of several other *Lacon* species, such as *L. humilis, L. lateralis,* and "Q" species; larvæ of the first-mentioned two species are seldom found in cultivated fields although their adults are sometimes there. *Lacon* "Q" sp., together with *L. variabilis,* may be found damaging strikes in new, badly-drained country which had been broken up for the first time during the early part of the year.

In future plantings in this type of country it will be found that, when the season is suitable, *L. variabilis* will be present in larger numbers than before, whilst *Lacon "Q"* sp. larvæ will have practically completely disappeared. In the laboratory it is not difficult to induce *L. variabilis* to oviposit in fairly loose soil, but when gravid females of the other three mentioned *Lacon* species are confined under similar conditions only a few eggs are obtained. All these species will, however, lay eggs in flower pots in which the soil has been pressed down and left until grass has grown in them.

Reaction of Adults to Light.

White to yellowish light does not attract *L. variabilis* adults and this species is very seldom found amongst the "click-beetles" which come to light in houses during the wet season or after the early summer rains. Using an acetylene light and white sheet, attempts to collect Elateridæ were made in several localities at different times during October-February periods. In Table II. are found details of some of the collections.

TABLE II.

RESULTS OF COLLECTING AT LIGHTS, USING AN ACEYTLENE LIGHT PLACED ON A WHITE SHEET. LABORATORY NUMBER OF COLLECTION AND NUMBER OF SPECIMENS ARE GIVEN, TOGETHER WITH TIME AND DATE.

Species.	No. 1. 4th Nov., 1931, 8 p.m. to 9 p.m.	No. 3. 19th Nov., 1931. 9 p.m. to 10 p.m.	No. 5. 7th Nov., 1931. 9 p.m. to 10 p.m.	No. 10. 13th Nov., 1933. 8.30 p.m. to 10 p.m.
L. assus	7	52	23	..
L. humilis	..	..	98	15
L. variabilis	..	..	..	2
L. lateralis	..	..	5	35
H. carinatus	..	3	..	26
H. cairnsensis..	..	37	..	..
Other Elateridæ	..	..	3	1

It was whilst making collection No. 3 in a field of plant cane which had been slightly damaged by wireworms (this field was bedded up

during the final ploughing), that *variabilis* adults were seen on cane leaves. No. 5 was made in a low, wet scrub following heavy rain during the day and No. 10 in a well-drained stock paddock in very close proximity to a depression in a cultivated field where *variabilis* adults were known to be present. On some occasions, when collecting with lights in a wireworm-infested field, the lower leaf sheaths of cane have been bent down to expose the beetles but none came to the lights. If adults are exposed to light during the day time they may fall to the ground, but in any case, after remaining inert for a short period they seek shelter under any available cover as quickly as their comparatively sluggish movements wil allow.

Adults of the *Heteroderes* species move much more quickly than do those of the *Lacon* species studied; also the former sometimes take wing when disturbed. This shelter seeking is not wholly caused by heat from the sun, as it also happens in cool, shady situations.

Feeding Habits of Adults.

The adult stage of *L. variabilis* is not directly injurious to cane. In the laboratory it was found that females bred from larvæ would not oviposit until after very light feeding, and potato tuber was provided for them. It is thought that, in the field, the softer underground portions of plants are their chief source of food.

Distribution of Larvæ in the Fields.

As previously stated the larvæ of this species are confined almost exclusively to badly-drained country or parts of fields. The soil in most of these situations is from 9 to 14 inches in depth, light in colour, poor to fair in quality, and with an impervious clay subsoil. However, provided drainage is bad, soil type seems to be of little consequence in so far as *L. variabilis* habitation is concerned. (Note briefly Table III.*) These wireworms are present in the darker flood country at Proserpine, in "glue-pot," and during some seasons strikes in excellent alluvial flats with several feet of soil over gravel may show "wireworm" misses here and there in the bottom of depressions.

Distribution of Larvæ in the Soil.

First-stage larvæ seldom leave the top 2 or 3 inches of soil. The other larval instars have been found at soil depths depending upon soil moisture conditions at the times of examination. When fork hoeing, or supplying after rain (also after heavy dews in very low, wet country) many larvæ are to be found within an inch of the soil surface, whilst after a spell of very dry weather the older larvæ, if in the mobile state, descend to immediately above the clay. The movement of larvæ in the soil, according to moisture distribution, has resulted, on occasions, in rather spectacular effects. It has happened that some fields known

* At one time some attention was paid to the water-holding capacity of the soils. Later during this wireworm investigation, but before complete mechanical analyses of the soils were done, it was considered unnecessary to continue with the project. The moisture equivalents and sticky points observed are given in this table.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to be inhabited by a considerable *L. variabilis* larval population had been planted when the soil moisture had been very low. The results were good showings of primary shoots. At this stage a shower of rain was experienced. The larvæ came up to the top 2 or 3 inches of moist soil and, as this moisture quickly disappeared they descended. During this movement of the larvæ they came into contact with primary shoots, &c., with the result that within three days following the shower fully 70 per cent. of the originally healthy primary shoots showed "dead-hearts."

TABLE III.

RELATIONSHIP OF DENSITY OF LARVAL POPULATION TO DRAINAGE, PERCENTAGE ORGANIC MATTER, SOIL TYPE, AND LOCATION.

No. of Soil Sample.	Farm.	Moisture Equiv. (30 g. per 30 min.)	Sticky Point.	Percentage organic material.	Soil Type and Location.	Density of Larval Population.
		%	%	%		
1	A	30·45	34·84	5·2	Wash in a water-course planted to cane	Large in suitable seasons, bad strikes result
2	A	25·76	29·18	4·2	In a shallow depression	Very much smaller than No. 1
3	A	35·25	35·76	5·4	In hollow, badly drained	Large in suitable seasons, bad strikes result
4	A	16·55	22·21	3·8	Dark, rather sandy, high well-drained land	No wireworm damage; no *variabilis* larvæ ever found in this country
5	A	31·75	34·20	5·0	In a depression	Similar to No. 2
6	B	16·98	29·37	1·0	Very low, greyish	In suitable seasons a very large population is present; extensive damage
7	B	22·07	29·80	2·8	Depression in higher land	Similar to Nos. 2 and 5
8	B	19·69	29·48	2·0	High land, light	*Variabilis* larvæ not present
9	B	15·55	25·11	2·4	High land, darker than No. 8	*Variabilis* larvæ not present
10	C	15·21	20·00	0·9	Low, light coloured	In suitable seasons a very large population is present; extensive damage
11	C	15·10	20·90	1·9	From same field as No. 10; higher part	Very few *variabilis* larvæ present; no damage
12	C	18·55	19·33	1·3	Low	In suitable seasons a very large population is present; extensive damage
13	C	9·33	17·19	1·4	Sandy ridge in same field as No. 12	No *variabilis* larvæ found on this ridge
14	D	27·86	32·04	4·6	Good river bank soil, well drained	No *variabilis* larvæ found in this country
15	D	28·15	36·00	5·2	Similar to No. 14, but nearer old lagoon	Similar to No. 14
16	D	35·23	47·1	4·4	On slope to old lagoon, much darker than No. 15	In some seasons the population is large enough to cause scattered damage
17	D	38·90	49·3	3 2	At bottom of old lagoon, very dark, badly drained	In most seasons population is very large and strikes are complete failures

On one occasion when making inspections in a field where several trash-bound stools of cane were growing, it was seen that all the soft

eyes amongst the damp trash to a height of 6 inches above ground level had been damaged by wireworms. In three instances a *Lacon variabilis* larva was found in an eye.

No larvæ have been found to enter the clay subsoil although this point has been investigated in suitable localities on a number of occasions. In the laboratory a series of drain pipes were filled with soil and clay in a manner such as to simulate natural field conditions as nearly as possible. Six half to full-grown *variabilis* larvæ were placed in each pipe and a glass tube was let down to a different depth in each of the pipes. The soil and clay were allowed to dry out slowly, except near the ends of the glass tubes down which small volumes of water were poured periodically. Invariably the larvæ, if mobile, were found in the small amounts of damp soil near the ends of the glass tubes which did not enter clay. In the pipes where only the top portion of the clay and the soil immediately above it were slightly damp the larvæ were found in the damp soil only. Where the top portion of the clay and all the soil had very nearly dried out the mobile larvæ were found scattered in the soil.

Food and Feeding Habits of Larvæ of L. variabilis.

The larvæ ingest soil, eat into the soft and distended eyes of setts and the sides of the underground portions of cane shoots, and burrow into the ends of the setts themselves. When soil has been the chief food the straight alimentary canal shows through the integument as a dark line. The eyes of setts are not attacked until they become swollen and soft. The softer rind of top plants, the root bands, root eyes, and rootlets* sometimes show the results of *L. variabilis* feeding. Sliced potato tuber and sprouting seeds of corn and wheat have been successfully used as food for larvæ during rearing work in the laboratory. Attempts to persuade larvæ to attack whole potato† tubers always failed; when this material is used as food the larvæ will burrow into the cut surface only.

As is usual with many wireworm species when a number of *L. variabilis* larvæ are confined together in a small amount of soil cannibalistic tendencies are shown. Even second instars have been observed feeding on the internals of their fellows of somewhat similar size. The older larvæ, when in captivity, will also attack small larvæ of the *Scarabæidæ* and of the *Asilidæ*.

The larvæ are voracious but, normally, feeding‡ is not a continuous process throughout larval life. Under conditions such as the presence

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* Wireworm feeding on rootlets and roots has no appreciable effect on cane under any climatic conditions in Central Queensland.

† Wireworm damage to cane has evidently made such an impression in the Mackay district that these pests are thought by many persons to damage locally grown potatoes, beans, and many other plants. In every case investigated the Potato Moth (*Phthorimæa operculella* Zel.) was responsible for all damage to potatoes, and the Bean Fly (*Agromyzia phaseoli* Coq.) was the cause of damage to beans. The damage to potatoes was usually observed during storage.

‡ More detailed accounts of larval feeding, larval instars and their stadia, and the relationship between larval growth and the moisture and temperature of larval habitat are given in a previous publication (McDougall, 1934).

of vegetable material and suitable soil moisture, it is limited to short periods immediately following each larval moult.

Response of Larvæ to Extremes in Environmental Conditions.

Any of the larval instars can withstand excessively wet soil environments for considerable periods. In the laboratory larvæ have been kept for five months in soil with moisture content well above its sticky point. Larvæ have been found in cultivated fields on which water has been lying for as long as four weeks; such larvæ are always in a healthy condition.

During rearing work it was found that the early larval instars require excessive soil moisture for their existence at summer temperature for Mackay. The smaller instars died if the moisture of the soil was allowed to fall to a point lower than about three-quarters of its sticky point. Half to full-grown larvæ, however, have been kept alive for six months in soil (sticky point 29·8) which dropped during that period from a moisture content of 15·7 per cent. to 5·1 per cent. (calculated on oven-dry weight of soil). Absence of vegetable food has very little serious effect on any of the larval instars other than retarding the normal rate of development. Larvæ have been reared through as many as four instars in pots of fresh soil, moist or wet as required, without addition of other food at any time. A parallel series of larvæ was reared in similar pots, and to these latter small pieces of potato were added at different times. Provided no larva had moulted since confinement and had not progressed as far as the immobile pre-ecdysal state, the tuber was always eaten into within a day of its being supplied.

Life History.*

The species *Lacon variabilis* has one main generation a year; the adults appear from late October to early February, but in greatest numbers in November and early December. Within a fortnight after their emergence from the soil, adults may no longer be found under the various covers as they have by then disappeared into crevices of the soil; the depth to which they penetrate very seldom exceeds 3 inches. At about three to four weeks after the emergence of the females the first batches of eggs are deposited. In the laboratory female adults have been kept alive in pots of damp soil for as long as six months and in glass tubes without soil or food for three weeks but field observations indicate that the life of a female adult under natural conditions seldom exceeds seven weeks. It has been found to be more difficult to keep males alive in captivity for more than four weeks. When adults of both sexes which have been reared from pupæ were confined in pots of damp soil, the males die at or just after the time when the first batches of eggs were laid. The egg stage usually occupies eight days, occasionally seven or nine, and rarely ten. There are eight larval instars and, under suitable conditions, the mean duration in days for each of the stadia was, from first to eighth, 9·5, 14·9, 18·9, 20·2, 28·2, 32·8, 38·2, and 152·0,

* More detailed accounts of larval feeding, larval instars and their stadia, and the relationship between larval growth and the moisture and temperature of larval habitat are given in a previous publication (McDougall, 1934).

respectively. Each stadium is found to be varied by the absence or presence of vegetable food and by soil moisture fluctuations due to the changes in weather conditions. The pupal stage occupies from thirteen to sixteen days, usually fourteen days.

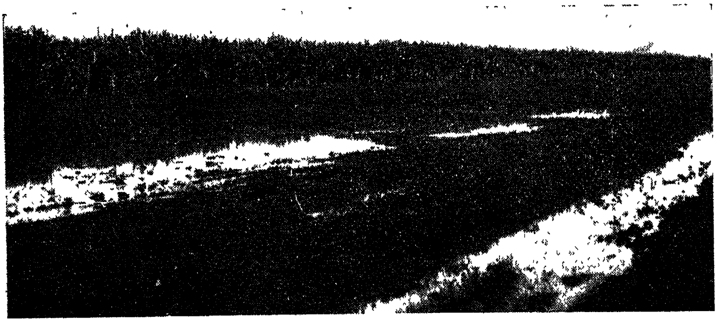
Although of very little economic importance there is a small percentage of the *L. variabilis* population which exhibits a two-generation a year life cycle. From eggs deposited during the period November to January there arise a few larvæ which pupate during the following March or April. Females from the April-March pupation have been kept alive in the laboratory until the following February, but attempts to induce some of them to oviposit at such a late stage of their unnatural existence failed. Intensive search for adults has been made in suitable localities in fields during late June to September, but since none has been found, these autumn adults evidently live no longer, under natural conditions than do those which emerge during early and mid-summer. Some autumn adults occasionally oviposit under field conditions and a few of their progeny become imagines in the following summer. When the stadia of the larvæ which become adults in autumn are compared with those of larvæ which take around three hundred days to complete their larval life a shortening of some is evident. The seventh and eighth are greatly reduced whilst many of the others also experience some reduction. The earlier stadia of larvæ from autumn adults are considerably lengthened at the expense of a shortening of the later ones.

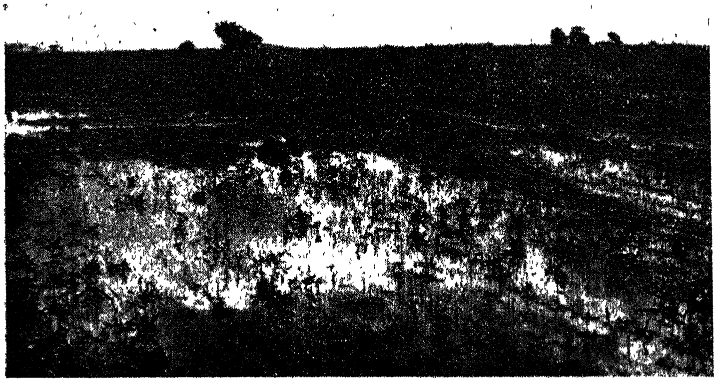
Some of the larvæ of both of the short-timed generations pupate after passing through only six larval stadia. However, the majority that ultimately give rise to adults have the normal number of larval instars.

Control.

Much has been written about the control of wireworms* in many parts of the world, but as remarked by Graf (1914) "probably no other insects have had more remedies tried for their control and with less success." As *L. variabilis* has been a pest to cane in Central Queensland mill areas for many years, it is but to be expected that a number of the remedies referred to above have been tried out by farmers with varying results. Also several field observations have become the bases of hypotheses offered as help in arriving at a successful solution of the problem under discussion. During the present investigation it was considered necessary to undertake some work along the lines suggested by previous recommendations as well as following what is now generally accepted as a standard method of attacking the problem of controlling a wireworm pest of a crop such as sugar-cane. In some instances these two parts of the project overlapped. Methods of control are discussed under the three headings of Biological, Chemical, and Mechanical. The methods which are advocated for the control of this pest under general farm conditions are set out on page 725.

* C. A. Thomas (1930) has reviewed the literature on the control of wireworms up till July, 1930; an excellent bibliography of the more important publications is appended to this review.





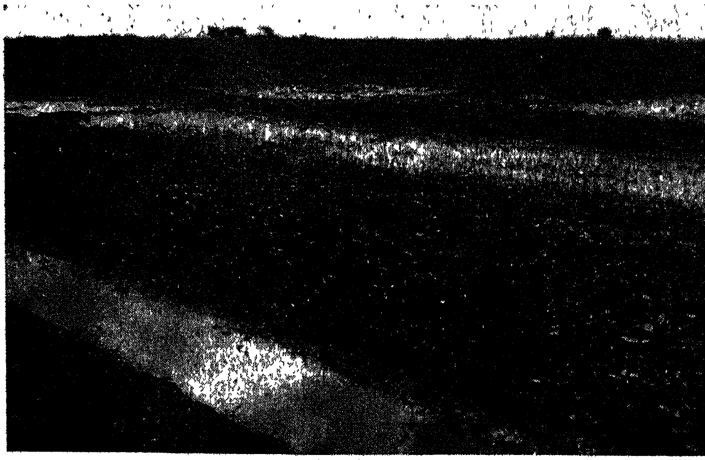


PLATE 301.

Views of "wireworm" fields, three to four days after heavy rain during a wet season. (Photos. by F. E. M. Clarkson.)

Biological Methods.

No parasites or predators of the larval, pupal, and adult stages of *L. variabilis* which could be considered to be of any economic importance have been found. Up to the present the egg is the only stage which has not been intensively studied in the field. The entomologists of the Experiment Station of the Hawaiian Sugar Planters' Association have also searched unsuccessfully for natural enemies of wireworms in some Queensland canefields. The fungi which are sometimes found on pupæ, adults and larvæ in the rearing pots or on pupæ in the field, are considered to be merely saprophytic. Mites, even when present in moderately large numbers, have no apparent effect on larvæ kept in captivity or on adults in the field. It is interesting to record, however, that dissections made during November to January of the somewhat toad-like frog *Phractops* (*Chiroletes*) *australis* Gray, showed *L. variabilis* adults along with several other insects, amongst the contents of the alimentary canal.

Chemical Methods.

All of the chemical methods tried have been directed against the larval stage of *L. variabilis*. It was early found that positive evidence derived from the use of poisons against wireworms in tins of soil in the laboratory was of little value when the experiments were repeated in the field. The experimental results here given concerning chemical methods are, unless otherwise specifically mentioned, from small field plots put out with the necessary checks in suitable localities only during early planting (March-April) or its immediate replanting. Plots put out during late plantings (July-August) were often very unsatisfactory. After taking into consideration larval feeding habits and larval stadia this could be expected (see "Times of Planting," p. 718).

The criterion which was taken as showing the success or otherwise of any poison was the amount of damage to eyes of setts and shoots. Four methods of applying the different poisons (cyanides excepted) were used:—

1. Dipping or dusting setts.
2. Placing poisons in drills with the setts.
3. Incorporating the poison with the soil surrounding the setts at the time of planting.
4. Introducing the poison into the soil close to the setts at a time when it was considered that the eyes were approaching a condition suitable for wireworm attack.

Table IV. gives results of most of the poison experiments; each has been duplicated in two different fields.

TABLE IV.

RESULTS OF SMALL FIELD TRIALS WITH CHEMICALS AGAINST *L. variabilis* LARVÆ.

Chemical.	Dosage.	Method of application.	Results. (Number of eyes and shoots destroyed by the larva.) Check Plots.	Treated Plots.
Lead Arsenate	10% solution ..	No. 1	14 out of 15 ..	13 out of 17
Mixture of chopped grass, sodium arsenite (1 lb.) and molasses (8 lb. in 10 gallons of water	50 lb. of arsenite per acre	No. 2	19 out of 30 ..	22 out of 30
Paris green	200 lb. per acre ..	No. 1	23 out of 30 ..	20 out of 29
	200 lb. per acre .	No. 3	25 out of 30	28 out of 35
Sulphur	540 lb. per acre ..	No. 3	31 out of 31 ..	27 out of 28
R.V. 4 Soil Cleanser (33% free sulphur, 30% polysulphides and hyposulphite	680 lb. per acre ..	No. 3	31 out of 31 ..	28 out of 33
Slaked lime	510 lb. per acre ..	No. 1	19 out of 30 ..	23 out of 29
	1,000 lb. per acre ..	No. 2	19 out of 30 ..	17 out of 27
	2,000 lb. per acre ..	No 3	19 out of 30 ..	15 out of 31
Naphthalene and slaked lime..	400 lb. per acre of each ingredient	No. 2	19 out of 30 ..	17 out of 30
Naphthalene	800 lb. per acre (400 lb. each application)	Nos. 3 and 4 combined	14 out of 15 ..	15 out of 20
	600 lb. per acre* (300 lb. each application)	Nos. 3 and 4 combined	5 out of 20 ..	2 out of 23
Naphthalene (1 oz.) Carbon bisulphide (3 fluid oz.) and soap [after Krauss (1931)]	2 pints of 10 % solution per nine feet of drill†	No. 4	31 out of 31 ..	3 out of 31
Carbon bisulphide	350 lb. per acre ..	No. 4	19 out of 35 ..	16 out of 24‡
Paradichlorbenzene and CS_2 ..	300 lb. per acre ..	No. 4	19 out of 35 ..	14 out of 23‡
Paradichlorbenzene	680 lb. per acre ..	No. 2	23 out of 30 .	24 out of 33
	680 lb. per acre ..	No. 3	23 out of 30 ..	19 out of 30
Paradichlorbenzene and slaked lime	680 lb. P.D.B. and 510 lb. lime per acre	No. 3	14 out of 15 ..	12 out of 15
Orthodichlorbenzene	600 lb. per acre ..	No. 4	25 out of 30 ..	9 out of 11‡
Mustard oil and water, (50 ml. of oil made up to 500 ml.)	One litre per chain of drill at each application†	Nos. 2 and 4 combined	31 out of 31 ..	2 out of 2‡
25% Kerosene emulsion ..	1 litre per half chain of drill	No. 4	25 out of 30 ..	3 out of 4‡

* A late plant plot.

† 147 running chains of drill per acre.

‡ Only eyes not damaged by chemicals were counted.

Kerosene, orthodichlorbenzene, and mustard oil were found to kill sett eyes on contact and, when using carbon bisulphide, it was found necessary to be careful so as not to damage the eyes.

To the above list of poisons which were found to be ineffective in controlling *L. variabilis* when applied by the different methods as indicated, borax and sodium fluosilicate may be added. A chlorpicrin plot was put out during a late plant; both the results of the plot and

methods of handling this fumigant were unsatisfactory. Mention of a laboratory experiment with Paris Green may be of interest. The cut surfaces of twelve pieces of potato tuber were thoroughly coated with Paris Green, but on six of the pieces so treated small areas of the poisoned surface were well cleaned. Each of the twelve pieces of tuber was then placed in a pot containing damp soil and three-quarters grown *L. variabilis* larvæ which had just moulted. It was found that the thoroughly-protected food supply had not been touched, whereas of the other six pieces of potato three had been tunnelled by larvæ entering through the small, clean areas on the poisoned surfaces. It would seem that a similar happening takes place when cane setts, planted in a wireworm-infested locality, are dusted with Paris Green. As soon as an eye swells and shoots a vulnerable portion of the plant is out of range of the poison protection applied during planting.

Various cyanides have been recommended as controls for wireworms attacking a number of crops including sugar-cane. In many instances, mention is made also of the possible harmful effect of these materials on plant life. Using cyanogas (calcium cyanide) no practical method has been found of successfully applying this material to the control of *L. variabilis* in the Mackay district without seriously injuring the eyes of setts. Even assuming the finding of an efficient attractant it is considered that pre-baiting is economically impossible.

Small doses of cyanogas when placed in the drills with the plants killed all the eyes. If placed at a minimum distance from the plants so as not to damage the eyes, the material was of no use in combating wireworm attack.

Portions of a *L. viriabilis* infested field were drilled out (drills 2 feet apart) and a dose of 200 lb. per acre of cyanogas was buried. Four weeks later, cane planted in these areas was attacked to the same extent as in the untreated parts of the field.

Mechanical Methods.

Hand Collecting of Larvæ.—It has been found that the laborious work of collecting larvæ from furrows behind ploughs is of very little help in decreasing the *L. variabilis* population in any field. Very few larvæ of this species will be seen during ploughing, and on a number of occasions two hours' following of the plough in certain portions of fields has resulted in the collection of not more than fifteen larvæ. When these same portions of fields have been planted, however, as much as 50 per cent. of each of the strikes has been affected by wireworms.

The same point is concerned when it is desirable to know before planting (particularly an early planting) if wireworms are likely to be troublesome. It was found that the apparent absence of larvæ during ploughing operations was not a reliable guide and that the planting and subsequent inspections of trial setts, usually in lots of five in the lowest parts of the fields, was the only satisfactory method of obtaining the desired information.

The Utilisation of Cane Varieties.—A few farmers consider that some varieties of cane are able to "resist" wireworm attacks to a greater extent than others. During the establishment of plots against wireworms many different varieties of cane were used and all were, under similar

Fig. 1.

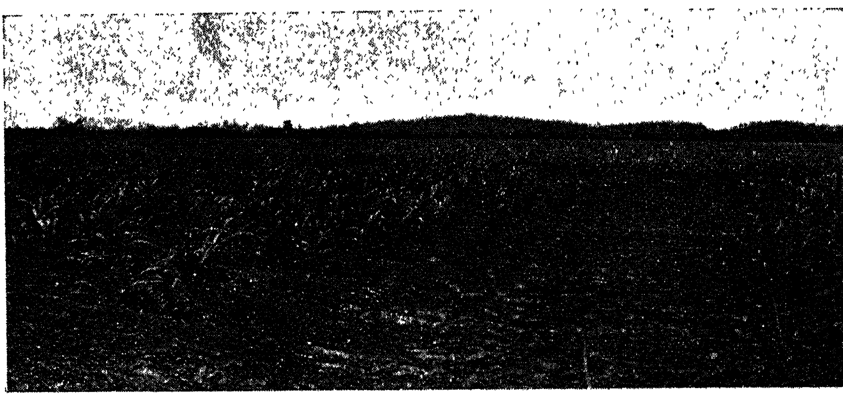


Fig. 2.

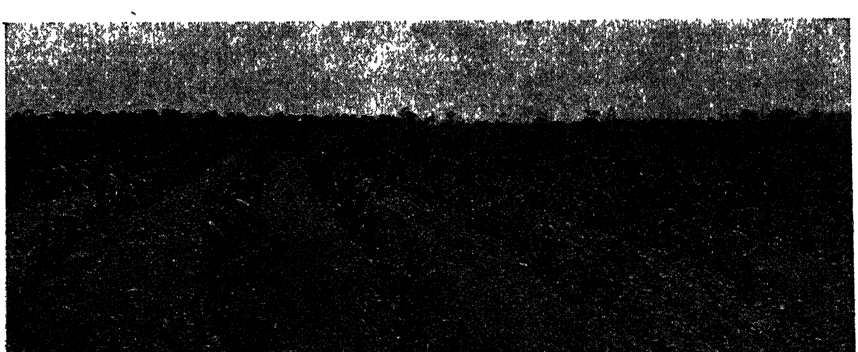


Fig. 3.

Good strikes obtained in reputedly bad "wireworm" fields after adequate draining at the proper time—i.e., during the summer previous to planting. Fig. 2 shows a "blind end" drain for taking water from an extensive depression in a field. (Photos. by J. Macmillan.)

PLATE 302.

conditions, equally damaged by these pests. When slow-striking varieties were planted out against quick-striking canes in a variety trial, many eyes of the latter class were destroyed before those of the former had been touched. Ultimately, however, the strikes of all the varieties were quite similarly attacked by the wireworms.

In Hawaii cane varieties have been put to good use in helping to solve a wireworm problem. Quoting from a communication (1-2-31) from C. E. Pemberton, Entomologist to the Experiment Station of the Hawaiian Sugar Planters' Association, "At present our wireworm problem has become less important because of the utilisation of cane varieties, such as Uba, which need be planted only once every ten or twelve years. As the plant crop is the only one that suffers, our Elaterid damage to a field is really very slight." Unfortunately, the habitat of the pest, its uneven distribution in many fields, the lack of varieties suitable for the purpose, and climatic and soil conditions make this excellent method of combating wireworms impossible in the case of *Lacon variabilis* in Central Queensland.

Rapid Early Growth and Use of Manures.—The getting away of plants as quickly as possible is often given as a subsidiary recommendation for the reduction of wireworm damage to sugar-cane, it being reasoned that when growth is slow the period of exposure to injury is prolonged. In the Mackay district, farmers point out that in seasons when there is relatively quick striking in "wireworm" country there is very little damage by the pests (*L. variabilis*). Probably, if immediate and apparent planting conditions are similar, the fundamental reason for the quicker striking in some years than in others is that following light or moderate wet seasons the soil has not been water-logged for as lengthy periods (if at all) as when the wet seasons are heavy. As will be demonstrated later ("Times of Planting and Seasonal Incidence," p. 718) there is a very good correlation between the density of the wireworm population in any year and the intensity of the preceding mid-summer rains. Quick striking of cane and the amount of wireworm damage are both dependent, to some extent, on the wet season, but it has not been found that quick striking is of much help at all in fields where feeding larvæ of *L. variabilis* are actually present in appreciable numbers. It must be remembered that the eyes of setts are not attacked until they are soft and swollen; soaked setts with swollen eyes or small shoots were planted during an early planting in a portion of a field where wireworms were known to be present and the planting moisture was good, but within three days after planting all eyes and shoots had been destroyed.

The use of manures in wireworm control is usually attributed to the stimulating effects on plant growth rather than to any direct contact insecticidal value. In the case of lime it is thought that its real value is due to its effect upon the physical condition of the soil. During 1931 a large lime and fertilizer trial against wireworms was established in the form of a 4 x 4 Latin square. On harvesting it was found that the yields from plots which had received an application of fertilizer in the drills and of lime in the drills were significantly better than the check plots. Results are not significant, however, in so far as the counts of "dead-hearts" and misses caused by wireworms concerned.*

Yields and percentage shoots and eyes damaged by wireworms:—

C 11·25 46·0%	D 11·79 53·4%	A 9·37 48·6%	B 9·78 42·9%
B 12·56 65·0%	A 11·70 41·6%	D 11·82 70·7%	C 9·95 34·5%
D 12·94 52·4%	C 11·95 53·9%	B 12·79 43·3%	A 11·17 51·2%
A 6·76 59·8%	B 9·40 47·9%	C 8·21 50·0%	D 7·79 42·5%

Variety.—Q. 813.

pH of soil 3·97

Treatments—

A—1½ tons burnt lime per acre, broadcast

B—1½ tons burnt lime per acre, broadcast +(200 lb. super. per ac.), (200 lb. potash per ac.) in drills.

C—No treatment.

D—1 ton burnt lime per acre, broadcast +5 cwt. of lime per acre in drills.

YIELDS.

ANALYSIS OF VARIANCE.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ loge (Mean Square).
Rows	3	30·51	10·17	..
Columns	3	7·19	2·36	..
Treatments	3	2·67	0·89	1·0930
Errors	6	1·28	0·21	0·3709
Total	15	41·65	..	..

Standard Error$=\sqrt{0{\cdot}84}=0{\cdot}92$ or 2·15 per cent.

SUMMARY OF YIELDS.

—	A.	B.	C.	D.
Cane, tons per acre	8·20	8·91	8·27	8·87
Cane, percentage mean yield	95·8	104·0	96·6	103·6

Yields from Treatments B. and D. significantly better than check plots.

PERCENTAGE SHOOTS AND EYES DAMAGED BY WIREWORMS.

ANALYSIS OF VARIANCE.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	3	54·83	18·28
Columns	3	384·75	128·25
Treatments	3	150·80	50·27
Errors	6	677·00	112·83
Total	15	1267·38	..

Standard Error.$=\sqrt{451{\cdot}3}=21{\cdot}2$ or 10·5 per cent.

No significant reduction in wireworm infestation resulted from any of the treatments.

Further trials with planting mixtures and complete fertilizers did not indicate that manures would be of any use whatsoever in helping to reduce damage by *Lacon variabilis*.

Some farmers have found by sad experience that it is a waste to place manure in the drills with plants in unimproved wireworm country. Nevertheless, the idea persists in some localities that superphosphates placed in the drills at the time of planting is a control for wireworms, and still other farmers consider that the use of burnt lime alone is helpful in decreasing the damage by this pest. Particular attention has been paid to the use of these materials against *Lacon variabilis*.

Lime (see also Chemical Methods, p. 710).—In addition to several smaller plots, two large plots (4 x 4 Latin squares) were set out incorporating different lime treatments in badly-drained depressions in two fields. The treatments were:—

A.—1 ton of slaked lime per acre, broadcast.

B.—2 tons of slaked lime per acre, broadcast.

C.—No treatment.

D.—1 ton of slaked lime, broadcast, with 3 cwt. of lime per acre in the drills.

Lime was applied broadcast immediately before final ploughing. Neither of the plots could be harvested; in one the strike was a complete failure; while in the second, which had to be very heavily supplied, relevant counts did not give significant results.

A pH survey of wireworm-infested fields showed that *L. variabilis* larvæ inhabited soil ranging in pH (in N/1 KC1) from 3·90 to 5·80, and that parts of any field inhabited by the pests were usually more acid than the remainder of the field. Soil samples for the purpose of this survey were taken from thirty-seven fields in different localities in both the Mackay and Proserpine districts. In the laboratary a series of nine jars containing soils, which at the beginning of the experiment covered a pH (in water suspension) range from 3·5 to 7·0, was adjusted by the addition of calculated amounts of N/5 sulphuric acid and water or burnt lime and water to a soil of pH 5·34. In each of these jars *Lacon variabilis* larvæ not smaller than the fourth instar were placed. It was found that in soil over the pH range under consideration, these larvæ could be quite easily reared to adults. It consequently does not seem that the addition of lime to a wireworm field would affect the wireworms inhabiting it by virtue of changing the pH of their environment. Larvæ have also been kept for considerable periods of time in jars containing half slaked lime and half soil; their behaviour was normal.

Superphosphate.—During the eight to nine months following March, 1932, larvæ were kept in soil and superphosphate; the largest amount of the fertilizer in any of the jars was equivalent to an application at the rate of 150 tons per acre. Ninety-two per cent. of the larvæ, the smallest of which were fourth instars when the experiment was initiated. passed through the larval moults in normal fashion, voraciously attacked

potato tuber when it was supplied to them, and finally emerged as adults. Six out of ten larvæ in the jars containing the very heavy dressing came through to adults. There is no doubt that superphosphate as a direct insecticide, or as a factor in changing environmental conditions, has no deleterious effect on *L. variabilis* larvæ.

In addition to the several trials with fertilizers containing superphosphate, four small plots with superphosphate only were put out. The following is an example of the layout of these small plots and the count (Table V.) as usual, indicates the futility of using this material against *L. variabilis* during a season when the pest is active in any field:—

Check (1)	Super (2)	*Date of planting*: 3-4-32.
Check (3)	Super (4)	*Variety*: Q. 813.
Super (5)	Check (6)	*Treatment*: Superphosphate placed in the drills at the time of planting at the rate of 882 lb. per acre.
Check (7)	Super (8)	

Size of plot: One chain by 4 drills.

Four replications.

TABLE V.

COUNT OF A SUPERPHOSPHATE TRIAL AGAINST *L. variabilis*.

DATE OF INSPECTION—1-5-32.

No. of Small Plot.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total number of swollen eyes on plants	79	70	70	74	72	76	72	72
No. of apparently good shoots	14	8	5	4	11	6	10	2
No. of shoots damaged by wireworms	17	14	19	30	16	18	14	27
No. of eyes damaged by wireworms	40	44	44	40	38	49	45	38
No. of shoots and eyes damaged by *P. australis*	6	4	2	..	7	3	3	5
*No. of shoots and eyes being attacked by wireworms at the time of inspection	11 (7)	8 (6)	6 (3)	..	2 (2)	1 (1)	1	1 (1)
Percentage of possible shoots and eyes damaged or being damaged by wireworms	90·14	96·96	97·06	94·59	86·15	93·15	85·51	98·51

*This includes apparently good shoots (in brackets) if, at the time of inspection there were no indications above ground level of "dead-hearts."

The Growing of Green Manure Crops and Clean Fallowing.—Many acres of cane land in the Mackay district are planted to green manure crops each year. On well-drained country it is not asserted that these cover crops, which are normally grown between October and March, have anything to do with wireworm infestations, but where the low lands are concerned—i.e., where wireworm damage occurs—many farmers are

of the opinion that the growing of these legumes encourages wireworms. When a green manure crop is successfully grown and ploughed in in a wireworm-infested field, it is thought that the increase in humus may be responsible for the pests attacking the setts. When the green crop is a failure, through water-logging or other reason, it is often considered that this failure may be the partial cause of the wireworms attacking the plants.

As indicated in Table III., wireworm damage occurs in fields covering a range of percentages of organic material in the soil, which is fairly wide for the Mackay district. Again the ploughing-in of an exceptionally heavy bean crop does not to any great extent effect the position of the percentage organic material in the soil in a range of ·9 to 5·4. From field observations, and the results of field surveys and laboratory experiments, there seems to be no relationship between the percentage organic material in the soil and the incidence of wireworm damage.

It might be thought that the growing of cover corps during November-February—i.e., the period of the adult existence of the pest—may provide excellent and attractive cover for the click-beetles. There is no evidence to show that adults of *L. variabilis* have a preference for green manures as cover; in fact, it has been found that they are not selective in this regard. An attempt to keep a portion of a low, badly-drained wireworm field as nearly a clean fallow as practically possible over a November-February period, did not result in the absence of wireworms in the portion of the field during the following twelve months.

Eradication of Couch Grass.—Of all the true grasses in the Mackay and Proserpine canefields, one of the most persistent and one of the most difficult to eradicate is Couch grass (*Cynodon dactylon*), which is very often to be seen in low hollows or depressions, and sometimes elsewhere in otherwise clean fields. It has been suggested that this grass attracts wireworms, and that its removal from fields would be of some use in freeing the soil of the pests. Probably the true explanation of the observations on which this suggestion is based is that Couch grass is quite likely to be present in the habitat desired by *L. variabilis* larvæ, and also that Carab larvæ have been mistaken for wireworms. Considerable numbers of larvæ of *Gnathaphanus pulcher* (see page 699) are to be found amongst the roots of Couch grass. During the past three years over 200 specimens of this larva have been received by us as wireworms found under Couch grass.

Times of Planting and Seasonal Incidence.—It is well known that while early plantings (March-April) may be severely damaged by wireworms, replants in July-August (the time of late planting) in the same fields may sometimes be affected but little if at all. In this connection, the following points in the life history and habits of the pest are of interest:—

1. The adults are present in the fields in greatest numbers during late November and early December; over the period mid-December to February, the adult population decreases very rapidly.

2. Taking early December as the time when the adult emergence is greatest, and adding four weeks for the preoviposition period, two weeks for the oviposition period, eight days for the egg stage, and 163 days for the first seven larval stadia, the time around which very many of the larvæ pass into the eighth larval instar, may be computed to be early July.

3. As, under normal field conditions, the larvæ feed only immediately after moulting, many of those which passed into the eighth instar during late June and early July will have finished feeding by the middle of July.

4. From a consideration of the normal feeding times of a larva, and the fact that the larval stadia progressively increase, it follows that the percentage of smaller to moderate sized instars in the population at any time will bear a direct relationship to the percentage of the larval population feeding at that time.

Briefly summarising these points and their consequences, it is found that during early planting, when many of the larvæ are small or of moderate size, the feeding of the population as a whole is practically continuous. By the middle of July many of the larvæ have finished feeding, while the majority of those present which are still feeding do so individually at less frequent intervals. From the middle of July onwards, the percentage of the larval population which has finished feeding rapidly increases, and chances of obtaining strikes free from wireworm damage improve accordingly.

In July, 1933, many early plantings were affected by wireworms, and if the usual July-August plantings had been possible, there is no doubt that it would have given these pests an opportunity to add to the total of their damage to cane for that year. Winter and spring rains, however, prohibited late planting in wireworm country before September, with the result that strikes free from wireworm attacks were obtained.

Damage to cane by *L. variabilis* is more extensive and more intensive during some years than during others. It is known (McDougall, 1934) that the weakest point (and it is comparatively very weak) in the life cycle of this pest is during the period of the earlier larval instars which must have excessively wet conditions for their survival, especially at Mackay summer temperatures. In Table VI. is set out the rainfall for the past eleven years during the months when the vast majority of the larvæ are present in the fields as earlier instars. When these rainfalls are correlated with the remarks on wireworm damage to strikes during the different years, it will be seen that, as would be expected, the amount of rain during any mid-summer has a very decided bearing on the amount of wireworm damage during the succeeding year. As the rainfall is concerned with wireworm existenec inasmuch as it helps, with topographical conditions, to provide suitable environments for the smaller larval instars, its distribution as well as its total amount should be noted. Usually, if the total amount is fairly large, the distribution is such that it helps to keep certain localities excessively wet during a considerable portion of a December-February period. Planting year 1924 (Table VI.) provides a possible exception; here the 14·29 inches in the last part of February would have had more effect on the amount of wireworm damage for that year had it fallen, say, during the middle of January.

TABLE VI.

RAINFALLS IN INCHES, DURING SUMMER MONTHS PRIOR TO PLANTING, AND WIREWORM DAMAGE IN THE MACKAY DISTRICT FOR THE YEARS 1924-34; INFORMATION CONCERNING WIREWORM INCIDENCE IS COMPILED FROM VARIOUS PUBLISHED REPORTS, PERSONAL OBSERVATIONS, AND INFORMATION COLLECTED FROM RELIABLE SOURCES. THE RAINFALL RECORDS ARE THOSE OF THE MACKAY SUGAR EXPERIMENT STATION.

Planting Year.	November.				December.				January.			
	1–7	8–14	15–21	22	1–7	8–14	15–21	22	1–7	8–14	15–21	22
1924 ..	·14	·09	..	..	·15	·76	·07	2·18	·01	..	..	1·81
1925 ..	3·52	·57	1·80	·02	·42	·89	4·59	·27	..	·50	3·78	1·57
1926 ..	..	·31	·17	·05	..	10 90	·03	1·84	1·43	1·32	·87	..
1927 ..	..	..	·44	·69	..	·44	3·96	2·64	·20	1·94	1·63	4·55
1928 ..	·25	1·17	..	1 73	..	13 29	9·72	13·60	..	·24	1·68	1·56
1929 ..	1·47	·27	·05	5·10	·29	5 89	1·91	·56	2·35	7·74	1·73	4·51
1930 ..	..	..	..	·90	36	..	..	2·37	3·79	·78	5·33	19·04
1931 ..	·01	..	..	1·21	·83	·10	1·68	·10	..	·23	·56	3·33
1932 ..	·61	..	1·14	3 92	5·08	·16	..	·93	45	..	23·70	1·36
1933 ..	·18	..	·02	1·82	·09	1·83	·74	5·37	..	..	·02	7 25
1934 ..	·42	9·46	1·93	·01	·16	4·91	·39	·26	·66	·40	·78	3·17

Planting Year.	February.				March.				Rainfall for period Dec.-Feb.	Wireworm Damage.
	1–7	8–14	15–21	22	1–7	8–14	15–21	22		
1924 ..	3·33	2·09	1·47	14·29	2·10	1·70	·09	..	26·16	A few strikes damaged
1925 ..	4·13	·23	..	2·83	1·99	1·71	9·71	1·27	19·21	Strikes damaged by wireworms scarce
1926 ..	·01	3·78	·04	·06	·46	3·70	·68	4·52	20·28	A few strikes only damaged by wireworms
1927 ..	1·69	4·38	·07	1·54	3·48	5·87	·95	·42	23·04	A few strike only damaged by wireworms
1928 ..	3·43	6·02	9·60	9·44	8·97	·09	·15	13 31	68·56	The worst "wireworm" year on record. Damage both intensive and extensive
1929 ..	1·47	·44	·41	10·45	·03	7 48	1·58	3·08	37·75	Damage plentiful
1930 ..	2 10	·36	..	1·92	2·56	·03	·43	1·37	36·05	Damage plentiful
1931 ..	5·13	·01	·01	·17	·04	·13	2·03	3·11	12·05	Very little damage
1932 ..	..	·24	·74	1·02	·36	·15	·05	·20	33·68	A fairly bad "wireworm" year
1933 ..	5·30	9·23	4·97	1·42	·65	..	..	·31	36·22	Many strikes damaged during early plantings (*see* also p. 719)
1934 ..	2·72	·03	3·62	2·91	2·59	·81	·75	1·15	20·01	A few strikes only damaged by wireworms

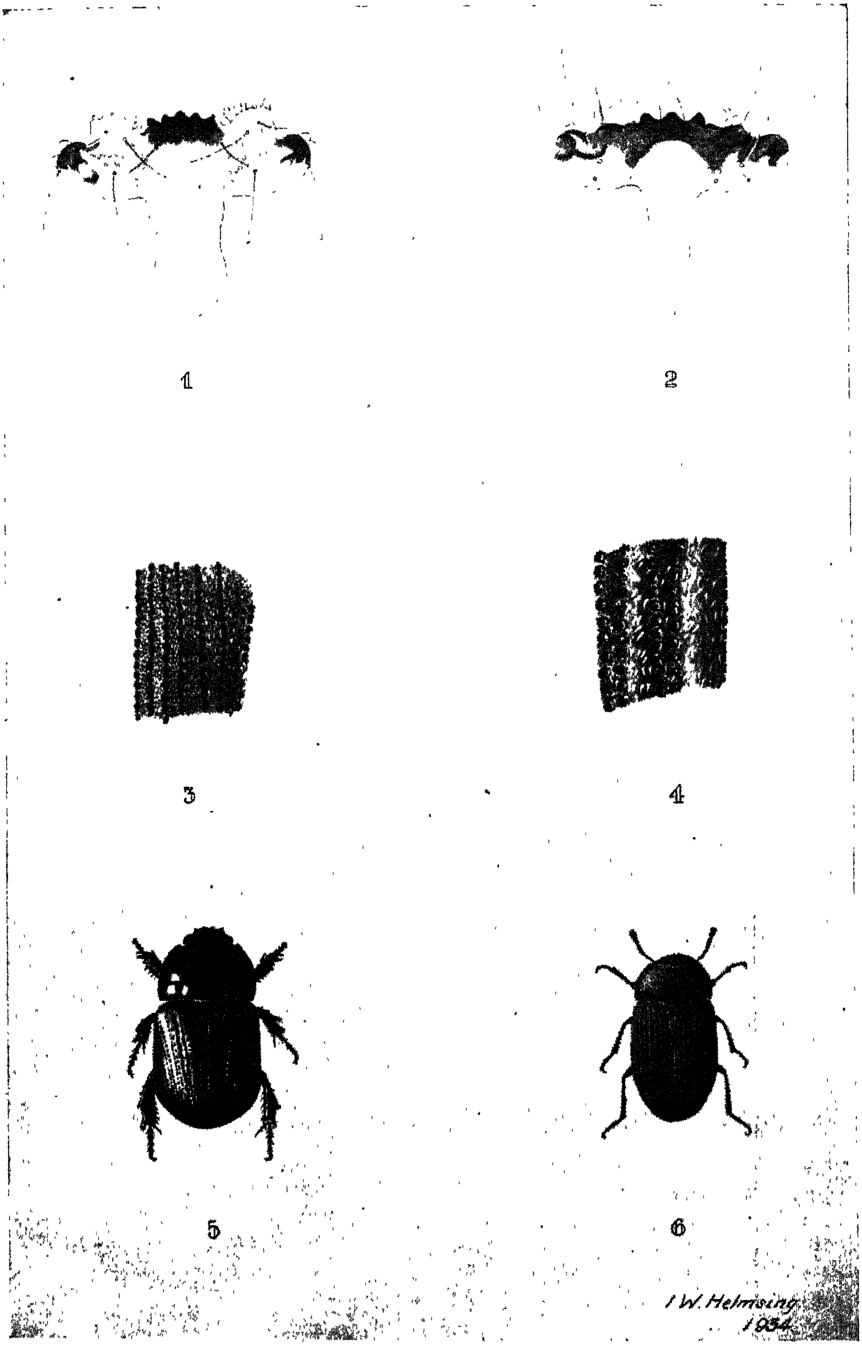


PLATE 303.

Fig. 1. Epistome and nasale of *H. carinatus* Blbn. x 24.
Fig. 2. Epistome and nasale of *L. variabilis* Cand. x 24.
Fig. 3. Portion of left elytron of *L. humilis* Er. x 15.
Fig. 4. Portion of left elytron of *L. variabilis* Cand. x 15.
Fig. 5. Adult of *Metanastes vulgivagus* Olliff x 2.
Fig. 6. Adult of *Dystalica mackayensis* Carter x 3.

Supplying and the Uses of some Cultural Practices performed immediately before or after planting.—As would be expected from a consideration of the preceding section dealing with times of planting, the supplying of wireworm misses with setts is very unsatisfactory. Such supplying to a damaged early planting usually means a more or less continuous performance if a full stand of cane is to be obtained. Supplying to a late planting may not be a distinct success unless the operation is deferred until as late as September or October.

In Fiji and Hawaii (Williams, 1931) a rather effective measure used against wireworms there "is to plant sufficient setts, over and above the regular amount, so that later on, if need be, the surplus can be used to fill in any gaps in the rows caused by the pests." The cost of labour, extent of damage in a large proportion of wireworm-affected fields, and weather conditions militate against the economic possibility and success of this transplanting in Central Queensland.

More as a matter of interest than as an experiment from which practical results could be expected, a trial was set out in which three-eye setts were planted vertically. One eye was just above ground-level. Certainly, the two lower root-bands of each sett provided roots, and the top eye, in many instances, a shoot, but the resultant stand of cane was very unsatisfactory.

It has been found that the thorough preparation of the land by ploughing operations or the rolling of the land and/or drills after planting has no effect whatsoever in preventing damage by *L. variabilis.* If these pests have become established in a field in sufficient numbers to cause appreciable damage, it can be safely stated that their presence will be felt, irrespective of any economic cultural practices which are likely to be undertaken around normal planting times.

Drainage.—The important finding of several workers on the control of "low land" species of wireworms is briefly stated by Metcalfe and Flint (1928):—"Certain species of wireworms are abundant only in poorly-drained soils The proper draining of such soils will entirely prevent damage by these species."

Naturally, as on many occasions, wireworm damage in Central Queensland mill areas had been noticed in low, badly-drained country, drainage had been recommended as a control of the pests, but drainage as practised by most of the local farmers did not seem to reduce wireworm damage. Nevertheless, as this investigation proceeded, it became more and more apparent that there must be some fundamental connection between bad drainage and the incidence of wireworm damage.

In a consideration of drainage as a control of *L. variabilis* there are several points from field observations concerning this pest and *Heteroderes carinatus,* from the studies of the life histories and habits of these two Elaterids, and from local drainage practice, which stand out as being very significant. These are—

1. The adults of both species will oviposit in soil under similar conditions. *Lacon variabilis* adults are usually found in very damp situations, but it is considered that the only reasons for this are—(*a*) the disinclination of the species to migrate; and (*b*) the secluded habits of the beetles making the finding of them in the fields, if they are not present in numbers, rather difficult.

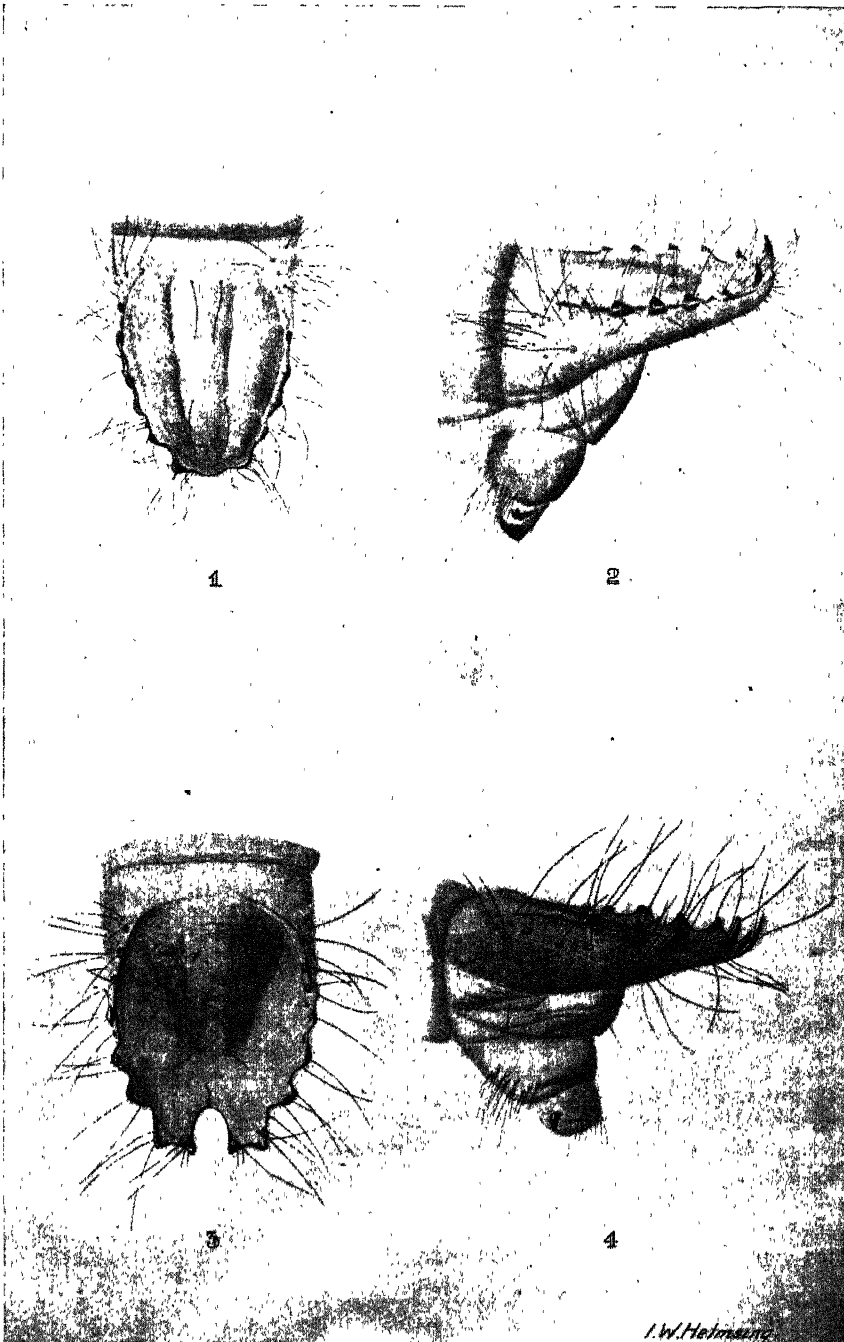


PLATE 304.

Fig. 1. Dorsal view of 9th abdominal segment *H. carinatus* Blbn. x 15.
Fig. 2. Lateral view of 9th abdominal segment *H. carinatus* Blbn. x 15.
Fig. 3. Dorsal view of 9th abdominal segment *L. variabilis* Cand. x 15.
Fig. 4. Lateral view of 9th abdominal segment *L. variabilis* Cand. x 15.

2. The smaller larval instars of *Lacon variabilis* must have excessively wet soil environments for their survival, whilst under similar conditions at the same room temperature those of *H. carinatus* cannot exist; in this latter instance a moderately moist soil environment is needed.

3. The older larval instars of both species can withstand varying environmental soil conditions. They flourish under similar conditions in the laboratory, but in the fields the larvæ of *L. variabilis* are almost exclusively confined to low, badly-drained country, and those of *H. carinatus* to the well-drained lands.

4. In fields or portions of fields where damage by *L. variabilis* occurs there are no natural or other permanent drainage systems. Drainage, if any, generally consists of the bedding-up of the fields during the ploughing operations immediately prior to planting.

If it is feasible to assume, as indicated above, that the distribution in the fields of *L. variabilis* and *H. carinatus* (the two species of Elaterid larvæ most commonly found in cultivated canefields in Central Queensland) is, to a large extent, dependent upon the soil moisture conditions encountered by their smaller instars, the drainage of *L. variabilis* infested country during the time when the larval instars are very small should control the pest. Similarly, it would follow that the bedding-up of wireworm fields immediately prior to planting—i.e., when the majority of the larvæ are over their early stages, would have no controlling effect on the pest. Local drainage methods as carried out in No. 4 above have time and again proved the latter portion of this conclusion to be correct.

From October, 1932, to June, 1933, weekly soil moisture samples were taken from both wireworm-infested and wireworm-free parts of fields on four farms in widely-separated localities. The different soil types encountered and the lack of an entirely suitable "single value" soil constant do not tend to make the interpretation of the results of this sampling either easy or accurate. However, for most field purposes, it can be said that on *L. variabilis* infested parts of fields, surface water will be present during considerable portions of the December-February period prior to the planting year (*see* Plate 301). The most heavily wireworm-infested portion of any of the fields concerned in the soil moisture sampling was under water for six weeks (periods of one and a-half weeks and four and a-half weeks) during December-February.

For the purpose of correlating laboratory and field work on the relationship of wireworm existence and soil moisture of environment, the results of the soil moisture sampling were taken as indicating that when the soil moisture of a part of a field is very close to or above its sticky point for considerable periods over December-February it is a suitable habitat for *Lacon variabilis*.

During the years 1932 and 1933 several farmers found that their strikes in erstwhile wireworm fields were quite free from damage after they had scooped headlands, filled in or drained depressions, bedded up the fields, and provided efficient outlet channels for the surface water during the mid-summer rains prior to plantings (Plate 302, figs. 1, 2, and 3).

RECOMMENDATIONS.

The following methods, given in order of preference, for combating the wireworm *Lacon variabilis* as a pest of sugar-cane in the Mackay and Proserpine mill areas, are recommended as worthy of being put into general farm practice. Several progressive farmers have used these methods and, up to the present, have found them to be quite satisfactory:—

1. Permanent drainage of low-lying fields.

2. If, for economic or other reasons, permanent drainage is not practicable, the fields should be thoroughly drained as early as the mid-summer rains or wet season immediately prior to planting, and *not* left on the flat until ploughing operations during the month before planting.

3. If proper drainage is not carried out, planting should be left until as late as possible. Perhaps two reasons why fields may not be adequately drained could be mentioned:—(*a*) It is well known that the incidence of wireworm infestations in many fields is seasonal, and it is considered by some to be worth while trusting to luck for good strikes on these low fields or parts of fields at normal planting times. Often the initial expense of improving say, a depression of 1 acre in a field of 5 acres is not considered to be worth the immediate benefits obtained from such work. The fact that such an improvement is nearly always a permanent improvement and asset to the farm is overlooked; (*b*) some fields are so low that during most wet seasons it is not possible to drain them efficiently other than by a community drainage scheme, or at a very high cost. Many of these very low fields consist of a rather sandy soil above impervious clay. The low sticky point of the soil adds to the difficulties of draining these fields to a degree of efficiency sufficient to prevent wireworm habitation. The few damaged strikes found during a poor "wireworm" year are on this type of country.

Those who entertain reason (*a*) should be prepared, if their normal plantings are failures, to replant in September-October, and hope that the following early and mid-summer rains are such as to allow of reasonable working of the young cane.

ACKNOWLEDGMENTS.

It is desired to acknowledge the courtesy of Mr. R. Veitch, Chief Entomologist, Department of Agriculture and Stock, in making available the services of Mr. T. W. Helmsing, to whom thanks are due for the plates which have been prepared in such an excellent manner.

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The Toxicity of Yellow-wood.

(Terminalia Bursarina).

By K. S. McINTOSH, B.V.Sc., Animal Health Station.

ON the 1st October, 1931, a report was received from the District Inspector of Stock, Emerald, stating that losses among sheep were occurring in the district. Yellow-wood came under suspicion.

Later in 1931, a specimen of Yellow-wood was forwarded to the Botanist, who identified it, and stated that he did not know of any feeding tests or chemical analyses conducted with it.

The Chemist reported that the presence of saponins, alkaloids, hydrocyanic acid, was not detected on chemical analysis of the plant.

In March, 1933, the Senior Instructor in Sheep and Wool reported "Rickets" or "Staggers" in sheep and suspected Yellow-wood as the cause.

On 28th May, 1933, Mr. D. F. Stewart, B.V.Sc., visited Codenwarra and planned an experiment to test the toxicity of Yellow-wood, Mr. McCosker, owner of the property, having generously offered the Department sheep, pens, and all facilities for conducting the test.

On 18th August the sheep were penned, twelve test sheep numbered 1 to 12 and eight controls numbered 1*a* to 8*a*. The sheep were Merino wethers, 4 years old, and brought to Codenwarra from Barcaldine. There is no Yellow-wood at the latter place. The sheep were in fair store condition when the experiment started. The yards used are concrete draining pens. They are well fenced and shade is provided by means of a piece of hessian.

Although this experiment is not yet complete, the following progress report is submitted as it is felt that the results so far are typical of natural grazing on Yellow-wood leaves.

The Experiment.

The test sheep are given just as much Yellow-wood as they would clean up, night and morning, commencing on 18th August, 1934. The amount given was not weighed as the leaves are not removed from the branches.

The Yellow-wood was collected on the property from trees carrying most abundant foliage. Leaves were fully matured old leaves, no young leaves were fed. Trees were not in flower.

The control sheep were first given 1 lb. of lucerne chaff each per day. Later this was increased to 1½ lb. and later still 2 lb. The chaff is of good quality and free from molds and foreign plants.

At first water was supplied in kerosene tins, but later the sheep were allowed to water at a creek near by.

On 5th September, 1934, No. 1 sheep was off feed, dopey, and sick. Conjunctiva was yellow and icteritic; this sheep died on 11th September, 1934. Post mortem revealed enteritis and impaction. Solid lumps of plant fibre were found in the intestines. Liver and kidney appeared smaller in size than normal.

Following this, half an ounce of Epsom salts was given to test sheep as they were slightly constipated, but not to controls as these were normal.

On 24th September, 1934, test sheep were given ½ lb. lucerne chaff per day each, which was later increased to 1 lb. As the sheep put on condition the amount of lucerne chaff was decreased.

On 25th September, 1934, No. 2 had first "fit." Two more followed in yard whilst sheep were being weighed. On 28th September, No. 4 sheep showed symptoms of dopiness, loss of appetite.

October 3rd, No. 2 still taking "fits."

October 3rd, No. 4 still "sick" and "dopey."

October 6th, No. 8 appeared sick.

October 8th, No. 4 sheep appeared to be dying. It was killed and a most-mortem examination was held. All organs appeared normal. A nasal bot (*Oestrus ovis*) was found in the upper part of the nasal cavity.

October 13th, No. 8 began to take "fits."

October 18th, No. 11 sick.

October 22nd, No. 11 began to take "fits."

Since 25th September, 13th October, and 22nd October, Nos. 2, 8, and 11 respectively have been taking "fits."

On 25th October I visited the holding to make observations.

When pen was approached No. 11 immediately took a "fit," which lasted about ten seconds, then took another about five minutes later. When milled about in the yard Nos. 2, 8, and 11 all took several "fits" within half an hour. The sheep were raced up and down about 100 yards lane when the three affected ones took several "fits."

All three sheep were poor in condition, being much thinner than control and non-affected test sheep. On examination there were no demonstrable lesions except abrasions which were sustained during the "fits."

Nature of "Fits."

The sheep drops in its tracks as though stunned and lies trembling and rigid with extensor muscles of the neck and limbs strongly contracted. The sheep sometimes lies quite prone and sometimes props itself up and sways its head from side to side. The attack lasts from ten to forty seconds and recovery is quick. The sheep struggles to its feet and stands for a few seconds swaying unsteadily, then runs away to join the mob.

The presence of strangers, loud noises, and driving all seem to induce the attacks. Whilst sitting on the fence of the pen, No. 11, which appeared to be the worst affected, took "fits" about every five to ten minutes for about forty minutes. If sheep are driven continuously after "fits" no harm seems to result.

General Remarks.

Mr. McCosker informed me that the Yellow-wood tree sheds its leaves from autumn to late spring, depending on the season. In a cold dry season, practically all leaves fall in cold weather. Sheep eat leaves when they fall particularly when grass and herbage are scarce.

There is a clump of Yellow-wood trees just inside the gate of one of the paddocks, and when sheep are put in here they immediately feed on the Yellow-wood trees.

There does not appear to be any mineral deficiency on this property. In 1931 the owner supplied lick for sheep, but hardly any was taken.

Season.

No rain from the time sheep were penned till 12th October when 66 points fell. There have been a few showers since.

Since this report was submitted Mr. Hardy, District Inspector of Stock, Emerald, has reported that Nos. 11 and 2, which were placed in the control pen, have gradually improved, and Nos. 5, 10, and 12 have begun to take fits.

Summary.

1. Yellow-wood causes a peculiar type of nervous disorder, or fits in sheep fed on it.
2. The leaves are not unpalatable to sheep.
3. Losses of weight in experiment were probably due largely to the unnutritious nature of the leaves as compared with lucerne chaff (fed to controls) except in the case of affected sheep, which showed marked emaciation.
4. No actual deaths following nervous symptoms have yet occurred. The two deaths recorded seem to have been caused by the indigestible nature of the plant.
5. From information supplied by the owner losses by death appear to be almost, if not solely, due to sheep collapsing among branches and stones or falling into waterholes, &c., when seized with a fit.
6. According to Mr. McCosker's experience and my own observations considerable loss in wool production and condition results from the ingestion of Yellow-wood.
7. Unlike the nervous symptoms caused by Stachys arvensis, no harm seems to result if affected sheep are driven continuously.

Acknowledgments.

This experiment was planned by Mr. D. F. Stewart, B.V.Sc., and is being supervised in the field by Mr. Hardy, District Inspector of Stock, Emerald.

The Department is very grateful to Mr. McCosker, of "Codenwarra," who supplied sheep, pens, and other facilities for carrying out the test.

The Story of Butter and Cheese throughout the Ages.

By O. ST. J. KENT, B.Sc.*

THE story of butter and cheese takes us back to the early history of mankind, when dairying was in a very primitive state, and when dairy herds consisted of goats, cows, camels, mares, and sheep, owned by wandering tribes.

The milk from these animals was used as food, and entered largely into the diet of these early people. But milk, under ordinary conditions, does not keep very long, and it would have gone badly with these people, in times of scarcity, if they had not discovered some means of preserving the valuable nutritive constituents of milk. This they did by converting milk into butter and cheese. Just how long ago the first butter and cheese were made cannot be definitely stated, but the early writings give us some conception of the age of these two important articles. In the Scriptures, butter and cheese are mentioned on many occasions, and as far back as the Book of Genesis (18:8), we read that "Abraham took butter and milk and the calf which he had dressed, and set it before them." Other very early references appear in the writings of the Hindoos about 2000 B.C. The remarkable feature about all such early references is that the mention of milk, butter, and cheese is, in every case, incidental, and implies their previous use for an extended time.

Herd-testing an Ancient Custom.

While these two products were primarily made for food, they were utilised by different races for different purposes, and some of the uses to which they were put are very interesting, indeed.

In India, about 4,000 years ago, butter was well known, and besides being used as a food, it was also used for sacrificial purposes. In passing, it should be mentioned to the credit of the Hindoos of that period (i.e., about the year 2000 B.C.) that they valued their cows according to their yield of butter. Herd testing is therefore a very old custom.

A Highly Developed Art.

The Greeks and Romans ate plenty of cheese, but they did not use butter very much for food. This was probably due to the fact that cheesemaking was a highly-developed art with the Greeks and Romans, whilst the making of butter was confined to Germany and other northern European countries. It was quite possible that, by the time the butter reached Rome and Athens, its flavour was anything but pleasing, a factor that evidently influenced its consumption by those Mediterranean people. The Greeks and Romans used butter more as an ointment to enrich the skin and as a dressing for the hair. They also used it for skin injuries, and considered that soot from burnt butter was good for sore eyes. In Tartary, a piece of butter dropped into a cup of tea was considered very delicious by these people.

* In a broadcast address from Radio Station 4QG.

Butter as a "Cure-all."

In Spain, as late of the seventeenth century, butter was on sale in chemists' shops as a cure-all, to be used, as was specifically stated on the label, "for external use only." Its use as a dressing or cooling salve for burns and bruises has been practised all through the ages, and even to-day we find butter recommended for this purpose. Less than 100 years ago, large quantities of butter were burnt as oil in lamps, in no less a country than Scotland. Times must have been hard for the dairymen in those "good old days," for Scotch folk certainly have the reputation of being thrifty.

To-day, butter is almost exclusively used as a food, and few of us would consider purchasing it for any other purpose. In its early history, butter was enjoyed as a food by comparatively few people. Those who did use it, seldom ate it fresh. The practice was to melt the butter before storing it, and it was usually employed in cooking, rather than as a spread. In India to-day a substance known as Ghee is essentially melted butter fat, and its preparation undoubtedly follows a method that has been handed down through many generations.

Butter and Class Distinction.

Apart from the uses already mentioned, the possession of butter and cheese by these ancient people was long regarded as indicating wealth, and served as a means of distinguishing the rich from the common people. Butter was often stored by burying it in the ground, allowing it to remain there for years, and very often a tree was planted over it so that it would not be disturbed. Under these conditions it turned deep red and was highly prized. The owner's wealth was determined by the quantity that he had stored up in this manner. Even at the present time, evidences of this old custom are to be found in certain towns of northern India.

In years gone by, the Irish people used to bury their butter in bogs, either for the purpose of storing it against a time of need, or to hide it from invaders, or for the purpose of developing a flavour. It has been said that the Irish, and other peoples of early times, acquired a taste for rancid and high-flavoured butter; and this is supported to some extent by a quotation from Butler's Hudibras, which runs—

> "Butter to eat with their hog
> Was seven years buried in a bog."

Samples of this Irish Bog butter are dug up from time to time even to-day, although the practice of burying butter ceased in Ireland about the end of the eighteenth century. Quite recently two lots of butter were found buried in a peat bog, one in County Leitrim, wrapped in a skin, and the other in County Tyrone, contained in a tub with perforated wooden handles. The colour of these butters was greyish white, but they showed a few small specks of the original butter yellow in the interior. They were brittle and waxy and smelt like rancid tallow, and did not contain salt. Many such samples have been claimed from the bogs of Ireland, and archæologists have been able to show, from the nature of the decorations on their containing vessels, that these butters were buried, in some instances, as far back as the eleventh century.

In modern times we reckon the wealth of nations in terms of butter and cheese, and we also bury these products, but instead of putting them

under the ground, we bury them in cold stores under conditions that are well regulated and hygienic.

Ancient Methods of Manufacture.

Butter and cheese in olden times were evidently not the choice flavoured, attractive foods which we know to-day. It should be interesting, therefore, to see what methods were adopted in ancient times for the manufacture of butter and cheese, and to compare them with modern methods. Let us consider the methods of making butter first of all. The principle underlying butter-making is a simple one. Milk or cream is simply agitated until the small fat particles unite to form butter granules. The process of agitation or concussion necessary to make butter is called churning, and the churning may be accomplished in two ways. In the first method the milk or cream is churned by rocking or swinging the churn. In the second method, the churn does not move, but the cream inside the churn is agitated by means of a revolving paddle, or some similar contrivance inserted into the cream.

Both of these methods were adopted by the early primitive people, and they have been used in butter-making right down through the ages, even to the present day. The only difference is in the design of the apparatus employed, and the conditions under which the manufacture is carried out.

The earliest references to butter-making comes from India, and these were recorded in the sacred songs of the Hindoos about 2000 B.C. According to the historian Martiny, these ancient people made butter in a stationary type of churn. The milk was placed in earthern vessels and given a querling motion, either by beating it with the hands or by stirring it with a stick, flattened at one end. These were the forerunners of the modern dash-churns, which are used on many farms and in many households to-day. In a modern dash-churn, the dasher or agitator is either a piece of perforated wood or metal, which fits closely into a vertical churn.

The ancient Arabs and Hebrews used churns, of a rolling, swinging, or revolving type. Animal pelts were sewn up to hold milk, and thus constituted the churns. These crude churns were fitted to the bough of a tree, or in some other manner, and swung to and fro, after the fashion of a child's swing, until butter was formed. Sometimes a portion of the trunk of a tree would be hollowed out to form a churn and swung in a similar manner.

As civilisation progressed, churns of a better type were constructed, and to-day in our up-to-date factories we have huge barrel-shaped churns, driven by machinery, which are capable of turning out a ton of butter in one batch. There is a vast difference in the size, design, and mechanical perfection of the modern churn, when compared with the crude ancient churns, but the principles involved are the same to-day as they were 4,000 years ago. The modern churn has simply developed as a result of the gradual improvement of primitive equipment. It is easy to realise now, that butter obtained from churns made of animal skins could not have the same appeal to the consumer as does our modern butter, which is manufactured from pasteurised cream, and churned under excellent conditions.

The principles underlying cheesemaking to-day are also the same as they were thousands of years ago, but in modern times the methods employed are much improved, and are more scientific. Cheesemaking

is a simple process to describe. Milk is made into a junket as a result of the addition of rennet. The junket is cut up into small pieces, which are warmed to enable the curds to separate from the whey. The whey is drained from the curds, which are then salted and pressed into the shapes which are so well known as cheese. When the first cheese was made, we do not know; but it must have followed closely on the use of milk of animals as food. The processes adopted in different countries differed slightly, with the result that cheese of many different names were soon known. To-day there are more than 500 different varieties of cheese listed. The commonest and the best-known cheeses have taken their names from the country in which they were first made. Thus we have Stilton and Cheddar from England, Camembert and Roquefort from France; Gruyère from Switzerland, Limburger from Germany, Edam and Gouda from Holland, and Parmesan from Italy. As people from these countries migrated to other countries, they naturally carried with them the knowledge of cheesemaking peculiar to their native land, and established their methods in their new homes.

Cheddar Cheese.

The cheese which is made almost universally in Australia is called Cheddar cheese, introduced in the early days by settlers from England. Something of the history of Cheddar cheese may therefore be of interest. The first written record concerning this class of cheese is given for the year 1635, although it was evidently made for many years before that date. It receives its name from a little village in Somerset, where it was first made. At that time, almost 300 years ago, Cheddar cheese was in great demand, particularly when well ripened, and the cheesemakers found it difficult to supply that demand. In 1742 the price of Cheddar cheese was stated to be 6d. per lb. in England, a price which is rather interesting, in view of the fact that present prices are not so very different.

Progress in Manufacture.

In Australia some other types of cheese are being manufactured on a small scale. Swiss cheese or Gruyère cheese is made here now, and contrary to a somewhat common belief, it is made from cows' milk and not from goats' milk.

The most recent advance in the cheese industry is the preparation of a rindless cheese which is usually wrapped in tin-foil and attractively packed. This type of cheese is called "processed cheese," and is manufactured from Cheddar cheese by heating it in a special apparatus.

The great progress which the butter and cheese industries have made in the last thirty years or so has been due to many influences. The application of the Babcock test, which has enabled the farmer to be paid according to the butter fat which he sends to the factory, is amongst the most important. Another factor which had a tremendous influence on the dairying industry was the introduction of the farm separator. This machine changed the system of selling dairy produce entirely. Instead of the farmer conducting a milk business, it enabled him to conduct a business in cream, with its many obvious advantages.

The application of pasteurisation to butter and cheese has also had a profound influence on the development of this great industry, and last but not least, the application of scientific principles in regard to all phases of manufacture, has been instrumental in bringing butter and cheese to the standard of quality attained to-day.

H. W. BALL, Assistant Experimentalist.

EXCELLENT rains were experienced throughout the farming areas during November, so that the main summer crops should now be well established. November and early December is generally regarded as the most favourable sowing period for maize in this State, so that the tasseling stage will coincide with the late summer rains. Maize is Queensland's chief grain crop, large areas of fertile coastal and downs land being suitable for its production. The favourable seasonal conditions have also given a great fillup to the dairying and grazing industries.

WHEAT.

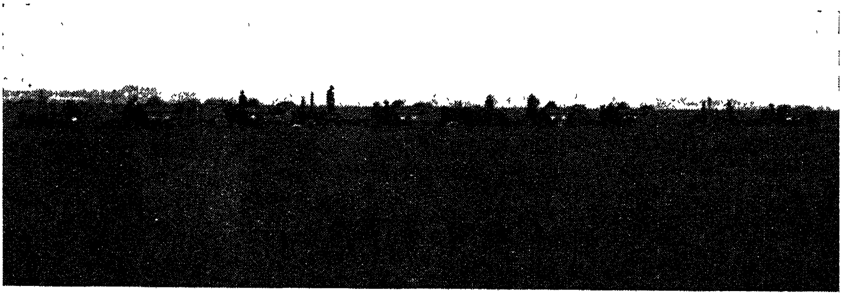
Reports of early harvesting operations indicate good average yields throughout the Downs area, many crops going over ten bags per acre. Unfortunately, the rains experienced have caused delay in harvesting the later crops, which, if prolonged, will affect the quality of the grain. The modern header harvester will gather all but the worst storm-lain crops, but some bleaching and shelling out of varieties such as Florence is naturally expected. However, harvesting prospects at the time of writing are much better than in 1933.

SUGAR.

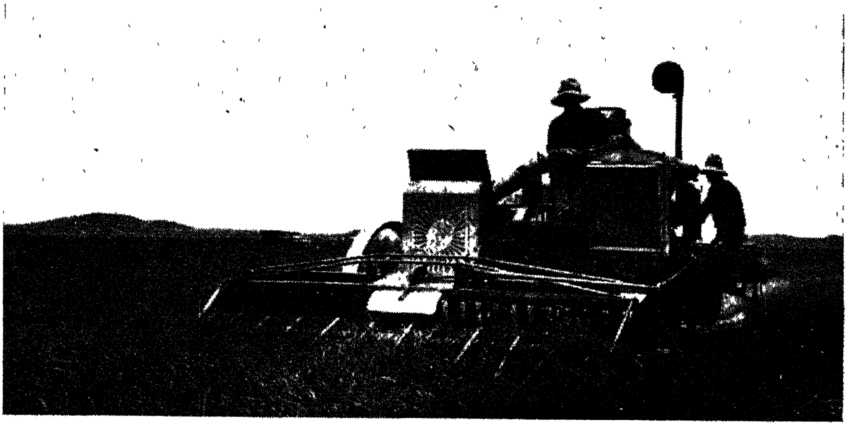
The month of November has been characterised by higher temperatures and beneficial thunderstorms in all cane areas. The crop is, therefore, making rapid growth, and prospects are bright for the 1935 crop.

The majority of the mills have completed crushing. Though the crops in the far North have been light, those of the Central and Southern areas approximate to record tonnages. The Burdekin mills have a large proportion of the crop still to harvest, while several of the Southern mills ceased crushing when an appreciable proportion of the crop was left as standover cane for 1935.

ON QUEENSLAND'S WIDE WHEAT LANDS.



Tractor-drawn Auto-headers at Work on Zeisemer Bros.' Crop, Bongeen, Darling Downs.



Auto-header Working on a Lodged Crop on Mr. J. Flegler's Farm, Evanslea, Darling Downs.

Grist for the Mill.—After the Auto-header has passed through Mr. J. Flegler's Farm, Evanslea, Darling Downs.

PLATE 305.

RECLAMATION OF PRICKLY-PEAR LANDS.

The prickly-pear has been routed on all fronts, and the menace of further encroachment overcome. Although regrowth and seedling pear

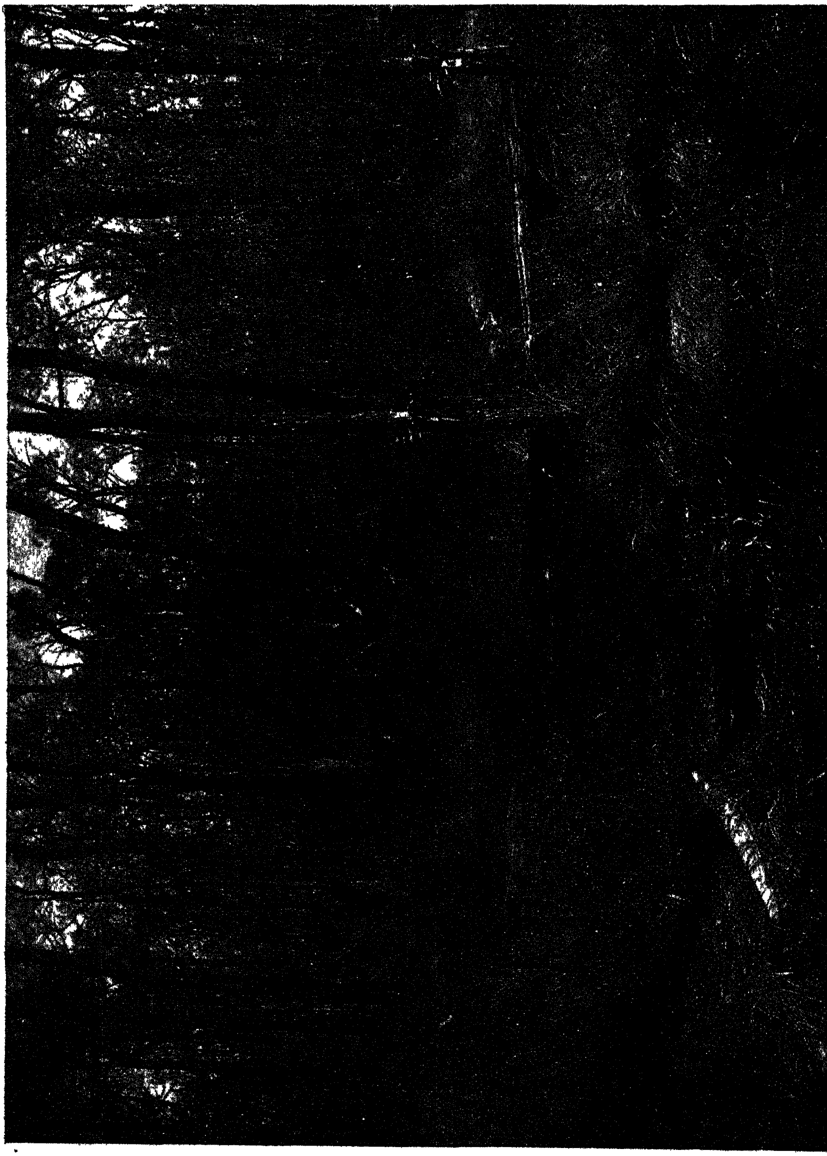


PLATE 306.—BRIGALOW AND BELAH SCRUB RINGBARKED EIGHTEEN MONTHS AGO NOW CARRYING A HEAVY COATING OF NATURAL AND NUTRITIOUS GRASSES. [*Photo., J. A. Lunn.*

will be in evidence for many years, it is safe to say that the cactoblastis will attack it with equal success. When the biological campaign was begun, about 60,000,000 acres in Queensland and New South Wales were either infested or subject to infestation, much of it so dense as to be regarded as lost territory. These lands have now been recovered, and ringbarking and other development works are proceeding. As much

of the land will carry a sheep per acre when improved, the reclaimed lands will be supporting many millions more sheep within ten years.

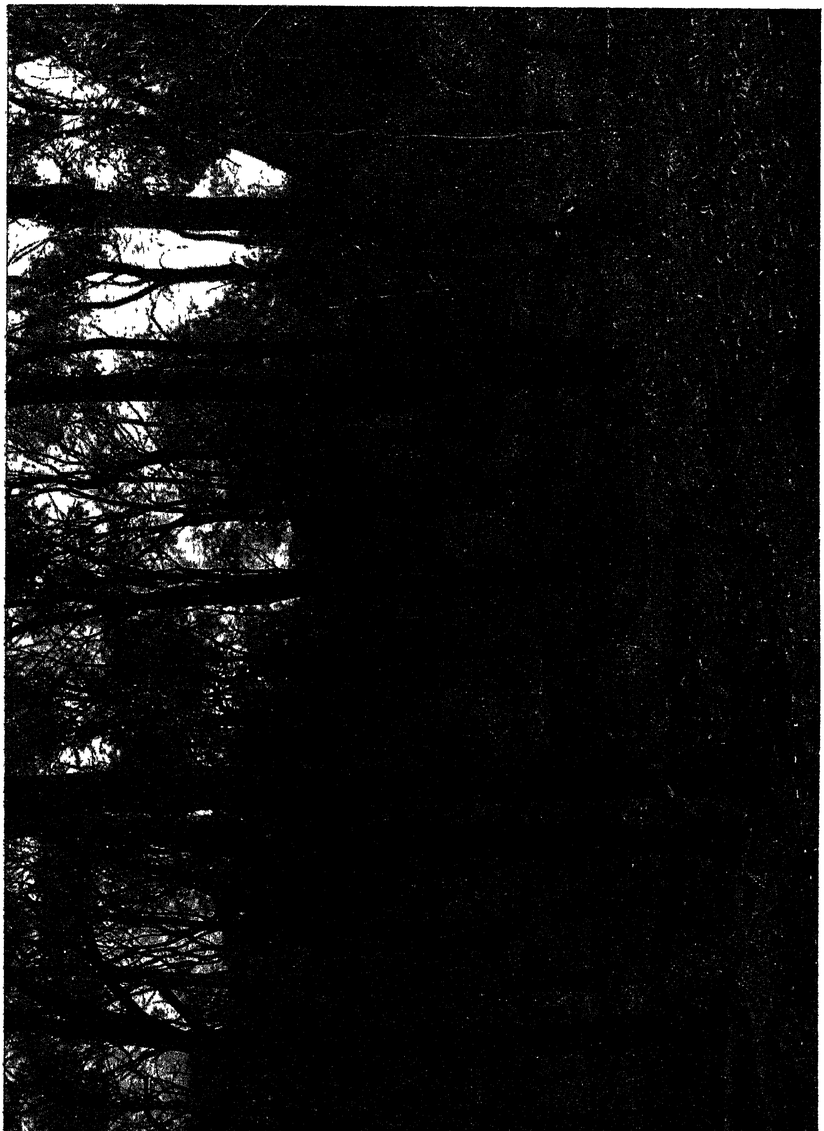


PLATE 307.—LIGHT BELAH SCRUB JUST RINGBARKED.—RECLAIMED PRICKLY-PEAR LAND, WESTERN QUEENSLAND.

[Photo., J. A. Lunn.

Many selections are now changing over from cattle to sheep, and considerable demand exists for any resumed lands as they become available. For instance, 286 applications were received for one block of land recently balloted for at Chinchilla.

COTTON.

The cotton areas, with the exception of a few favoured sections, may be described as about a fortnight late in obtaining general planting rains. Generally speaking, most of the crop was planted in the latter

half of October, following light storms which occurred frequently enough to ensure good strikes being obtained where well-prepared seed beds had been established early. A considerable acreage was ploughed following the first of the October rains, and fortunately ample soaking rains have occurred in the first half of November to allow these areas to be planted in good shape. Altogether, it is anticipated that fully 60,000 acres are under cotton this season.

The value of thorough early cultivation of the young cotton crop was well demonstrated during the past excessively wet season, and growers are making determined efforts to keep ahead of weed growth this year. The rains during the latter part of November have thoroughly soaked the soils to sufficient depths in practically all districts to ensure ample supplies of soil moisture, and clear warm weather is now required to enable the thinning and cultivating of the crops to be carried out properly.

TOBACCO.

Early sowing is favoured in the Texas and Yelarbon districts, the plants being now well established in the field, and the first gathering of leaf is expected in January. Seed beds are still being prepared in the Northern areas, where growers favour periodical sowings until assured of adequate supplies. Planting-out is mainly accomplished during December. Control methods adopted for preventing disease are proving effective, although prolonged wet conditions will necessitate increased vigilance. Some damping-off is reported, owing to keeping the seed beds closely covered up after watering. This can be prevented by adequate ventilation. The excellent tobacco lands in the Bowen district are attracting attention, two growers having averaged 33d. and 36d. respectively for their entire 1934 crop. In this district good results have followed planting-out as late as February and early March.

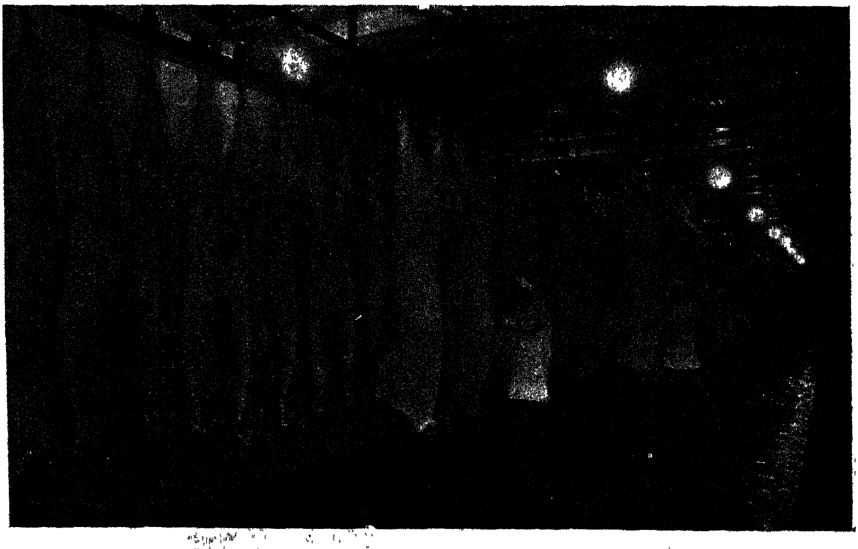
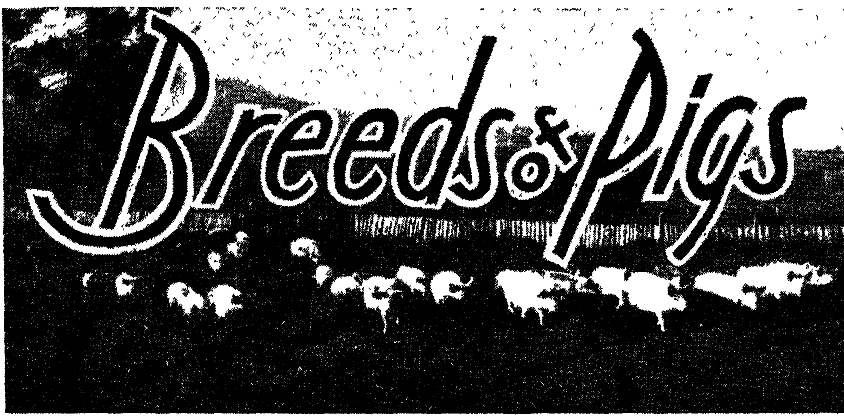


PLATE 308.—CHILLING FOR EXPORT OVERSEAS.

[Photo. by courtesy of Queensland Meat Industry Board.



E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

PART V.

THE WESSEX SADDLEBACK.

THE most recent introduction to Australia of the lesser-known British breeds, the Wessex Saddleback, has an historical record full of interest to the student of live stock husbandry.

History of the Breed.

The breed originated, like several other breeds in that part of the world, from the mating of two of the original types indigenous to England, a black-coloured breed originating in the New Forest—from whence sprang the Tamworth—and the old English Sheeted breed, so called because of its peculiar colour markings. It is on record that this new Wessex breed was not influenced in any way by the types which made the Yorkshire and Berkshire pigs famous—the Chinese and possibly the Neapolitan breeds. Perhaps this isolation was due to the locality in which the Wessex originated—the Isle of Purbeck, in the early days a part of the New Forest country. Later, a similar type was bred in Hampshire, an offshoot of which in these days has gained fame in America, where it is still referred to as the Hampshire, in colour and type not unlike the Wessex Saddleback as we know that breed to be.

Among other names that have characterised this breed in England is the Sheeted Hampshire, the type reputed to be the originator of the American breed of similar name. W. J. Malden informs us in his review of this breed in the Jubilee Issue of the "Pig Breeders' Annual," that the maintenance of the Wessex pig in pure-bred form was due largely to two families, one at Plaitford and the other at Langford, where they had been maintained pure for over ninety years. These and their descendants in the neighbourhood formed the main basis of the pure Wessex as we know the breed to-day.

A Wessex society was formed in 1918; it issued herd books regularly, and amalgamated with the National Pig Breeders' Association of England quite recently.

The Wessex breed was originally developed for, and all along has been maintained, as a bacon pig, no attempt having been made to cross it with any other type for purposes of breed improvement. Such a breed must of necessity build for itself a reputation, for breeds are not established in a day, considerable effort and patient work being necessary to gradually mould a type into a recognised breed. It is unnecessary in this short review to discuss the early breeders of this type; sufficient to say they were and are well known to British stud masters, and the fact that the National Pig Breeders' Association thought so much of the breed as to be prepared to sponsor its interests speaks for itself.

PLATE 309.

Lined up at the feeding trough.—A scene on Mr. R. Turpin's farm at Lowood, in the Brisbane Valley district.

Characteristics of the Breed.

In his review, Mr. Malden offers the advice worth consideration here that it is unwise in a breed of this description to strain too much after length to the detriment of other qualities. It is claimed that the Wessex breed is a meaty and not a fatty breed, hence a medium length, thick, meaty carcass will be preferred to one with more length but less meat. As a breed, the Wessex is included in the list of medium-framed breeds, not as large as the Large White and not as compact as the Berkshire.

As regards their suitability for Queensland and Australian conditions it is early yet to commend strongly or condemn a breed of which we have had but very limited experience. I would say that, from my experience, I consider the Wessex distinctly a bacon pig in its purebred form. As a purebred pig, and judging from the standpoint of the stud pig breeder, it would be fair to say this breed is disappointing, in that the number of well-marked pigs suitable for sale as show animals is very small, too limited in fact to make the breeding of Wessex pigs as purebreds a payable proposition. If colour is to be a secondary consideration, a very doubtful and risky procedure, the breed would

figure to more advantage; but as they have to compete with whole-coloured breeds like the Large and Middle White and the Tamworth, and with a breed like the Berkshire, which produces a higher percentage of well-marked pigs, progress in the breeding of Wessex Saddlebacks will be slow and difficult.

Insufficient purebred animals of this breed have been available for slaughter in Queensland to be able to make a fair comparison, and with such a limited number of purebred animals available the future of the breed is certainly still in the balance—in fact until more data favourable to the breed is available locally one could not honestly recommend them except for experiment purposes. Their colour, and the fact that for choicest grade porkers they do not dress out to the same advantage as pure white pigs, present a slight hindrance not so noticeable in bacon pig production. It is possible, too, that where breeding is neglected or carried out on rough and ready lines, the Wessex would not show up to advantage in competition with, say, the Berkshire-Tamworth cross.

PLATE 310.

Championship winners at the Gympie District Show—the property of Mrs. A. Alford, of Traveston. These Wessex pigs are thoroughly typical of the best in this breed in Queensland.

OTHER BRITISH AND AMERICAN BREEDS.

This review of breeds of pigs would not be complete without passing reference to other British and American breeds that have been tested out and used in Australia, and in Queensland in particular.

The Large Black Breed.

This breed, formerly known as the British Large Black and the Devon breed, originated in Devonshire and has had a fairly wide distribution throughout the world. This breed has been bred and distributed widely in Australia.

Large Blacks were bred at the Hawkesbury Agricultural College, New South Wales, and at many other farms in that State, and Victoria; also to some extent in Queensland. Unfortunately, although this breed has points in its favour and could be used to advantage, there are so few really good Large Blacks in the Commonwealth that one is compelled to issue a warning against the use of this, one of the oldest of British breeds. They have, however, a long and honourable record

in the land of their origin, and, perhaps, may some day regain some of their former popularity in Australia.

The Gloucester Old Spot.

This breed is another having its birth in the environs of Gloucestershire, in the British Isles.

Somewhat large and loose in frame, having long-lopped ears and generally regarded as a very growthy breed, these Old Spotted pigs appealed to many breeders, especially as the sows, like the Large Blacks, are prolific and heavy milkers. Unfortunately, there is a coarseness about the G.O.S. which makes it unpopular, and unless breeding is very carefully controlled—which, unfortunately, is not the case on many farms—best results are not obtained.

It is quite unlikely that the G.O.S. will regain its former but temporary popularity, especially as even in Great Britain they are giving place to more popular types like the Large and Middle White.

PLATE 311.

Born and bred in Queensland from imported parents, this young Wessex sow is the property of Mr. R. Turpin, of Lowood.

Other British Breeds.

Other British breeds that have not been introduced into Australia, but have their share of popular favour in the United Kingdom, are:—The Cumberland, the Essex, Large White Ulster, Lincolnshire Curly Coated, National Lop Eared, and the Welsh National Pig (sometimes referred to as the British Landrace pig).

American Breeds.

Of a number of breeds of pigs originating in the United States of America, three only have been introduced into Australia. Named in order of merit as judged by length of time bred here, they are:—The Poland-China, the Duroc-Jersey, the Chester White.

The first two mentioned only will be referred to herein, as the Chester White, apart from being introduced and tried out, has not proved suitable, and has been deleted from our list of breeds. In fact, American breeds generally are not favoured in Australia, and are gradually being eliminated in favour of the more popular and suitable British breeds.

In America the hog is considered as the principal medium for converting corn into coin, and as the American people are great believers in both corn and coin, they have specialised in the production of animals that will most efficiently "walk their crops to market," and convert their corn crops into dollar bills with the least waste, in the quickest time, and with the expenditure of as little labour as possible.

PLATE 312.

A comparison of type between the Wessex and the Tamworth, this prize-winning Tamworth sow, "Traveston Alice," bred by Mrs. A. Alford, won several championships for Mr. Mat. Drummond, of the Wide Bay Stud Piggery, Gympie, Queensland.

In pursuance of this policy of developing live stock specially suited to the purpose, several breeds have been evolved that have earned for themselves an enviable reputation, particularly in the United States, the world's greatest hog-producing country.

Of these, the first two referred to have had the widest distribution, the Poland-China having been bred in Australia for fifty years or more, although the modern type, of which there are still a few representatives available here, is comparatively a recent introduction.

In actual cross-breeding tests carried out in Queensland over a series of years, the Poland-China, in its association with breeds like the Large White and Tamworth in particular, gave very satisfactory results; even although the type of Poland-China available was not considered the most suitable.

Market requirements have changed so much in recent years, and the demand for more flesh and less fat has become so pronounced, that any breed with a tendency to produce an excess of fat must be discounted. For this reason, both the Poland-China and the Duroc-Jersey must be looked upon as undesirable breeds. They are not recommended by Queensland bacon-curers, although lengthy lean types of similar conformation are not actually objected to.

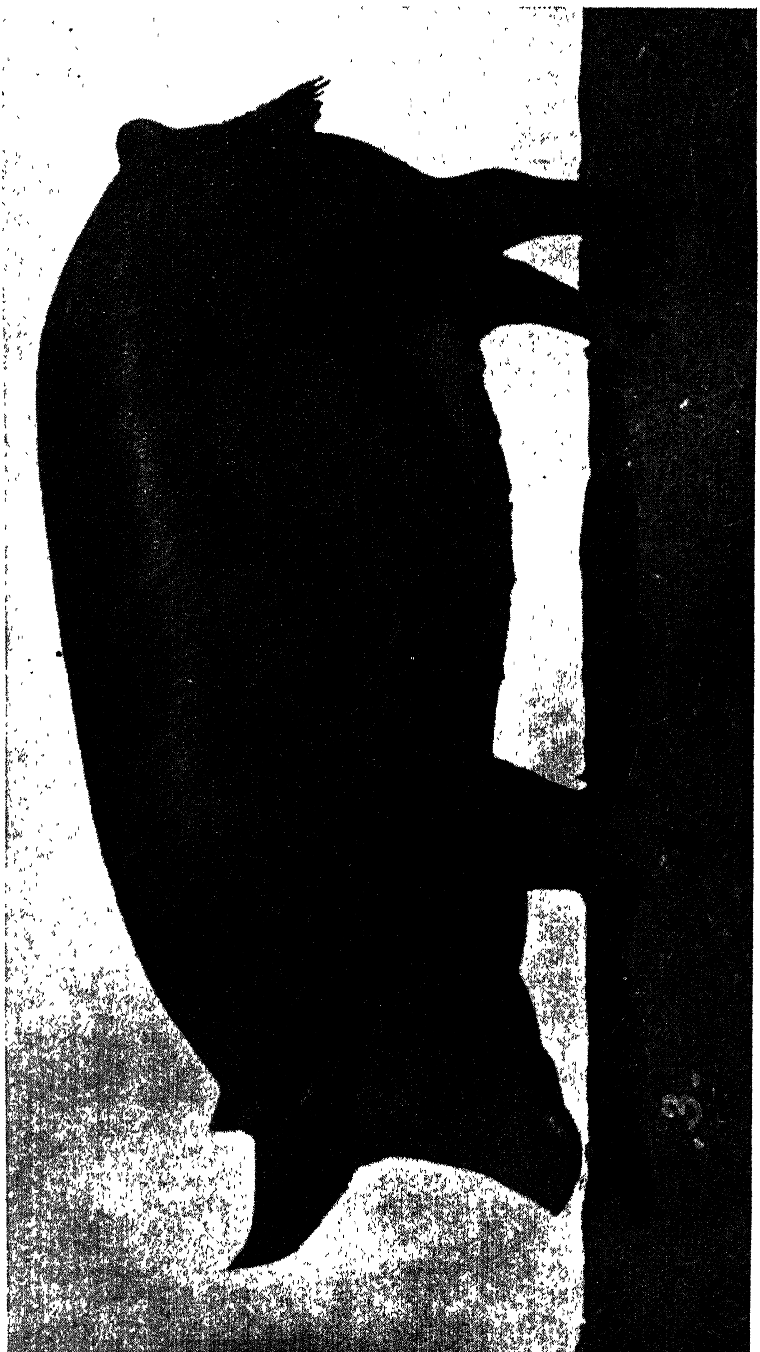


PLATE 313.

A foundation sow in the herd of Mr. C. G. Dale, of Lagoon Pocket, Queensland, this prize-winning Tamworth sow was bred by Mr. J. Barkle, of Kingaroy.

Our recommendation is to concentrate on the four breeds specially commended by the bacon-curers—the Large and Middle Whites, the Berkshire and the Tamworth—for in these breeds there is a sufficient range of types to enable selection to be made to suit varying needs. Besides, any advantage possessed by American breeds can be developed in British types by careful breeding, feeding, and management.

As we have it, the Poland-China is marked much the same as the Berkshire, although more white marking is permissible. In America there is another type—the Spotted Poland-China—very similar to the type that existed here thirty years ago.

The Duroc-Jersey is the red hog of America, developed like the Poland-China for purposes of utilising maize as the principal food.

The Chester White is a more lengthy, upstanding type fashioned along bacon lines.

All the American breeds we have possess small drooping ears; they are more cylindrical in frame than the Berkshire, which is squarely set; and they have an aptitude for fattening very readily on a minimum of food. There are several other American types that have not been introduced, two already referred to being the Hampshire and the Spotted Poland-China. The Mule Foot is one of the lesser-known American breeds reported to be immune to the more serious diseases like swine fever, in America known as hog cholera.

Plate 314.—Good-quality Export Porkers.

[*Photo. by courtesy of Queensland Meat Industry Board.*

The Queensland Pig Industry Act.

PROVISIONS EXPLAINED.

DESIGNED entirely in the interests of Queensland farmers who are producing pigs as a profitable branch of live-stock husbandry, "*The Pig Industry Act of* 1933" was assented to on 11th October, 1933, in the Queensland Legislature, having received Royal Assent in accordance with State law. The Act actually came into operation on 23rd August, 1934, which date is referred to as "the commencement of this Act." The Act is divided into twenty-five sections, while there are twenty-three additional provisions in the Schedule to the Act, which latter are largely covered by the Regulations. Sections 1 to 4 of the Act may be referred to as the administrative portion, covering, among other things, interpretation of various terms used in the text—thus, the word "dealer" is interpreted as meaning "any person who engages in the buying and selling of pigs or pig carcasses"; "piggery" means and includes any land, buildings, or place where pigs are depastured or kept; and similarly with other terms.

Inspectors under this Act have, for the purposes of the Act, all the powers and functions of an inspector under "*The Dairy Produce Acts,* 1920 *to* 1932," "*The Diseases in Stock Acts,* 1915 *to* 1931," "*The Slaughtering Act of* 1898," or any Act or Acts amending the same or in substitution therefor respectively.

Section 5 gives the inspector power of entry and inspection, and in his official capacity he may enter and inspect any premises or place where pigs are depastured or kept, and any factory. He is empowered to deal with any position arising as a result of unclean piggeries, disease in pigs, impure or unwholesome water or food, &c.; and he may forthwith order the necessary steps to be taken to remedy the defect.

Section 7 sets out the duty of the owner in notifying disease; isolating diseased pigs; disposing of diseased carcasses.

Section 8 prohibits the feeding of meat, offal, or blood unless such foodstuffs are thoroughly cooked.

Section 9 requires the owner to render any assistance required by the inspector in the carrying out of his duties, and in searching for and discovering the cause of disease or any source of contamination or infection to which pigs may be exposed.

Section 10 deals with the marking of pigs by a representative of a factory—i.e., a sufficient mark to ensure identification of the vendor or consignor if pigs are forwarded direct to a factory. Such identification marks are, of course, necessary in the ordinary course of marketing; otherwise there would be endless confusion.

Section 11 requires every auctioneer, agent, dealer, factory, or butcher to keep a record in respect to every transaction in pigs with which he is concerned—that is, the date, number, description, distinguishing marks, name and address of vendor and of purchaser, and such other particulars as may be prescribed.

Section 12 prohibits payment for the whole or any part of a carcass which has been condemned by an inspector as unfit for food of man; this is an important section, as payment for diseased carcasses has proved to be a most unsatisfactory way of eliminating disease.

Section 13 deals with grading of carcasses, and is more fully described in dealing with the Regulations.

Section 14 provides the inspector with power in marking of quality of carcass pork and bacon sides.

Sections 15 to 25 give powers of administration under this Act and provide for penalties in case of offence, &c.

The Schedule to this Act covers a fairly wide range of provisions and deals with subject-matter covered by regulation.

THE REGULATIONS.

In the Regulations additional terms are interpreted—thus, the grader is the person duly appointed as such under the Act and/or his assistants duly appointed under the Act.

A saleyard is a live-stock market operating as a saleyard, a receiving and/or trucking yard, or place where pigs are sold, bartered or exchanged, or otherwise disposed of, &c.

Regulations 1 and 2 are purely administrative.

Regulation 3 sets out requirements in conduct of examination of graders and/or inspectors under this Act, and is largely an administrative clause.

Regulation 4 provides that no person shall be employed in the grading of pork or bacon pig carcasses unless he holds the necessary certificate of competency under this Act.

Regulation 5 deals with management of piggeries which are not specifically provided for in any of the other Acts under which inspectors work in administering this Act.

Provision is also made that pigs shall not be allowed to trespass or to pollute running water. This Regulation also provides the inspector with powers to prevent introduction and spread of disease among pigs, &c.

Regulation 6 deals with identification of pigs, and requires that every pig offered for sale, barter, or exchange be identified in accordance with this Act and its Regulations, the object being to facilitate tracing of disease to source of origin. This Regulation is a particularly important one that will require the hearty co-operation of everybody interested in the progress of the pig industry.

Regulation 7 deals with grade definitions and defines the various grades into which carcasses will be graded by the grader at the factory.

Provision is made for two particular grades in each group—thus, there will be in baconers for the Australian trade a grade defined as choicest, and another first grade; carcasses not coming within these grades will be second grade or smallgoods grade, as the case may be.

In export baconers and in export porkers the grades are those required by the *Commerce (Trade Descriptions) Acts,* 1905 *to* 1930, and are the grades in operation at present under Commonwealth veterinary inspection.

In porkers for the Australian trade, in addition to the two grades referred to as "G.A.Q." (good average quality) and "F.A.Q." (fair average quality), there is a second grade and a reject porker grade. Boars and stags shall be accepted, graded, and paid for only when of suitable quality and age for manufacturing into edible products.

34

Regulation 8 deals with payment for pigs sold for slaughter, and requires that in the case of choicest or highest grade carcasses there shall be paid a premium of one halfpenny per pound above the rate paid for next grade. It is felt that the introduction of this system of payment will be entirely satisfactory, and will do much to encourage the breeding and marketing of better quality and properly finished pigs. This Regulation provides that when live pigs are sold at public auction and where carcass pork graded as provided is sold at public auction and/or by private contract, the clause requiring payment of premium shall not apply, for the reason that purchase of pigs at public auction and carcass pork ditto or by private contract requires the buyer to pay maximum value to secure the best quality offering, and, therefore, payment of an additional premium would not be workable.

Regulations 9 and 10 deal with the sale of live pigs by public auction and sale of carcass pork respectively.

Regulation 11 provides for the issue with account sales of grade certificates—i.e., where pig carcasses are paid for on a basis of grading. It is desirable the farmer be informed as to the reason why carcasses are paid for at below choicest or highest-paid grade, if they are so graded and paid for; and this Regulation paves the way for this information to be supplied.

Regulation 12 provides for check grading and for vendor to be supplied with a certificate of grade of all carcasses other than those of highest-paid grade.

The check grader shall also determine the grade of any carcass reduced in value by causes obviously occurring after purchaser has taken delivery from vendor. This clause provides for losses due to injuries in transit, &c., not actually covered by any preceding or following clause.

Check grading protects interests of the farmer and should be the means of providing him with necessary information, for, as stated, the farmer is to be informed in all cases where his pigs are not of choicest grade. It is hoped to be able to follow up grade certificates and indicate to the farmer how to overcome faults in type and condition, and how to produce and market the most desirable class of animal.

Regulation 13 deals with grade marks, and paves the way for identification by indelible grade marks of graded carcasses, thus preventing errors and enabling a more accurate check to be kept of the different grades. Where grading is carried out by Commonwealth officers (as in the case of pork for the export trade), only such grade marks as are required under the *Commerce (Trade Descriptions) Acts*, 1905 *to* 1930, will be applied.

Regulation 14 provides for compulsory refund of price paid for any pig whose carcass is subsequently slaughtered and condemned within thirty days of sale by Government inspectors as unfit for the food of man. Many pigs are purchased in Queensland and are paid for prior to slaughter. All such pigs come within the ambit of this Regulation and thus are brought into line with those consigned direct to factories and not paid for until slaughter and inspection is complete. The Regulation makes it compulsory for the purchaser to demand the refund, and for the vendor to pay within a stated period. This clause will, it is believed, be of inestimable benefit to the industry in this State.

Regulation 15 has reference to a similar subject, but deals with the purchase of live pigs by dealers who thereafter consign to factories for slaughter within thirty days. In this case the dealer is placed on the same footing as the farmer, and will be compelled to refund in case of condemnation. This clause will apply to every such transaction between a dealer and an owner of a factory.

Regulation 16 requires the owner of a factory to supply to the Minister a list of trade marks used, &c.

Regulation 17 requires the owner of a factory to supply to the Minister a list of all products manufactured or sold by such factory.

Regulation 18 provides for the use of more than one trade mark where so desired by the owner of a factory.

Edible products shall be identified with a different trade mark from inedible products such as fertilizer.

Regulation 19 makes it an offence to beat a pig with a whip, stick, or other weapon capable of bruising or damaging the carcass of such pig. Similarly, it will be an offence to ill-treat a pig in any way, penalty being such as is provided for in the Act.

Regulation 20 indicates the scope of the Regulations and is largely administrative.

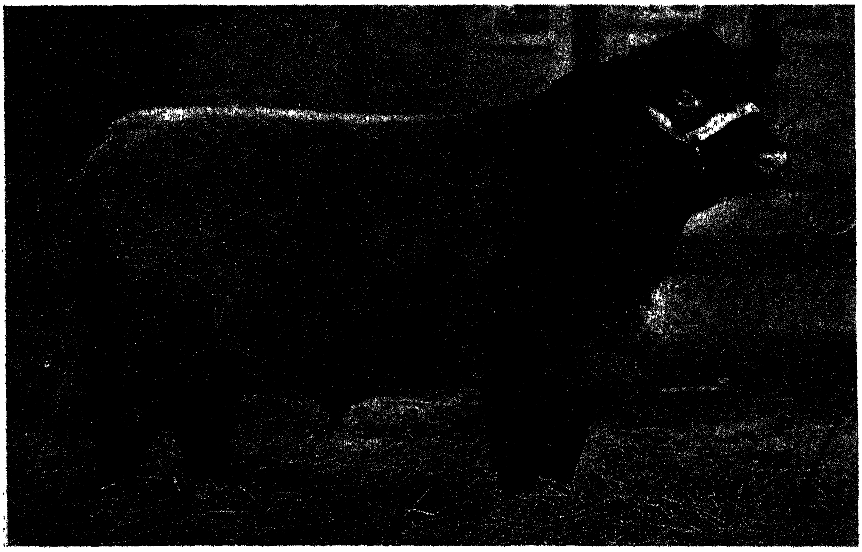


PLATE 315.—CHAMPION POLLED SHORTHORN BULL—A RECENT IMPORTATION.

[*Photo. by courtesy of Queensland Meat Industry Board.*

Fruit Market Notes.

By JAS. H. GREGORY, Instructor in Fruit Packing.

Apples.

IT is at this period of the year we often find consignments of so-called cookers which, as a rule, consist of small, immature, green fruit. Fruit of this description always has a detrimental effect of a lingering nature on market values from which it takes a long period for prices to recover. If sending early apples to market as cookers, growers should take care to see that the size of the fruit is not less than 2⅝ in. in diameter. Fruit of this size and larger will sell as cookers where smaller fruit is unsaleable. At the present time—late November—some splendidly-packed lines of Yates and Sturmers of good quality from Victoria and Tasmania are arriving and realising up to 12s. per case. Green fruit could not compete successfully with this fruit.

Stone Fruits.

Plums, apricots, and cherries, with lines of local peaches, are now arriving in quantities. Good, well-packed lines are meeting with a ready sale. Some consignments of Stanthorpe fruit have shown traces of fruit fly. This should serve all growers as a warning to take all precautions possible to prevent a spread of the pest. The rainy weather towards the end of November did not assist in helping to make a good early-season beginning. The humid conditions hastened considerably the breakdown of some of the riper lines. Care must be taken by growers to ensure that no wet or damp fruit is packed for market. Only dry and well-cooled-before-packing stone fruits will carry and open up to perfection. Again a warning is given to pay strict attention to packing-shed cleanliness if brown rot is to be kept in check.

Citrus.

The Queensland citrus season is now drawing to a close. It has not been a successful season. Small-sized fruit has been the cause of low prices during the greater part of the year. Serious attention will have to be given in the future to the elimination of fruit of this description, which has all along helped to create glut conditions. Two-inch mandarins and 2¼-inch oranges have proved particularly unsaleable throughout the season, and if the percentage of this quality had been eliminated an almost normally-supplied market would have resulted.

Tomatoes.

The quality of tomatoes during November has been one of the best ever produced in the State. Some splendid consignments have gone to Southern markets. The standard of maturity of the fruit this season has been raised far ahead of previous years. It would appear that this has had a stabilising effect on the markets, preventing speculators from buying at green prices and holding for a rise. As the warmer weather is with us, care must be shown in not sending fruit too far advanced in colour to distant markets. Packing has also shown improvement; the benefit of the school packing classes of previous seasons is now being felt.

Papaws.

Prices for papaws have increased considerably on the local market. Quality should still be the keynote of papaw marketing, all spotted or fungus affected fruit being carefully rejected. Although Melbourne weather has remained cool through November, warmer conditions can soon be expected, when papaws will need to be carefully selected to avoid the risk of their arriving over-ripe on the Southern market.

Pineapples.

With the winter crop over, pines generally are scarcer on the market. The shortage of pines and citrus on the markets is offset by the increased supplies of stone fruits arriving on the market. Medium-sized pines are selling readily at fair prices, but buyers are not keen to operate on small fruit. Growers sending South are gradually changing over to woodwool packing, which opens up in a much sweeter and less musty smelling condition than blady grass.

Miscellaneous.

Attention is drawn to the publication of a packing chart for apples in the standard export case. A packing chart for the Australian dump case is in course of preparation, and advice will be given in these notes when it is completed. Packing charts may be obtained free on application to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane.

Charts for both the dump and standard cases are now available for oranges. A lemon-packing chart is in course of preparation.

Intending apple exporters should watch for the appearance of the new grade standards for the exporting of apples, which will be published as soon as they come to hand.

The attention of growers marketing locally and using second-hand cases for packing is drawn to the fact that in many cases old brands are not removed from cases and replaced with the grower's name, address, variety of fruit, and grade. Growers have had to be dealt with for infringements of this kind which, it is hoped, will soon cease.

DEHORNING DAIRY CATTLE.

The dehorning operation should be performed while the animals are young. The dehorning of calves is best accomplished by the application of caustic to the horn "buttons"—the two small protuberances which can be felt when the animal is a few days old on either side of the poll where the horns emerge. The skin immediately surrounding each button should first be protected by smearing it with vaseline, and the button itself then carefully rubbed with the caustic pencil. Should the caustic touch the skin severe burning will occur, and areas of skin will slough off. For the same reason the caustic must not be handled with the fingers, but slipped for use into some metal holder, such as an ordinary pencil-holder. Four applications are usually sufficient, when the buttons will peel off, this marking the completion of the treatment.

The operation is thus performed without any pain to the animal, and the method is quite the most effective and humane. Adult cattle are sometimes dehorned by use of a special instrument, several kinds of which are upon the market, but it is a painful operation and is not recommended.

If cattle prove troublesome in the yard by horning others, much damage can be prevented by sawing off the ends of their horns, leaving them quite blunt. Care should be taken not to remove too much of the horn, and the sawn ends should not be filed round.

Crown Land for Selection.

TOCAL SHEEP COUNTRY.

Approval has been given for the opening for Grazing Homestead Selection of a subdivision of Tocal Resumption at the Land Office, Longreach, on Thursday, 17th January.

The block contains an area of about 30,000 acres, and is situated on the south side of the Thomson River, about 55 miles south-west from Longreach. The term of lease will be twenty-eight years, and the annual rental 2½d. per acre for the first seven years of the term.

The block embraces an area of very open downs, with a small area of fairly well-shaded gidyea and boree country. The remainder is open boree downs country, pebbly in places, and well shaded in patches.

Grasses consist of Mitchell, blue, water couch, &c., and the country is fattening. Fair woolgrowing and suitable for breeding.

Improvements consist of tanks, sheep yards, boundary and intersecting fencing. The present water supplies are sufficient.

The valuation of the improvements is £1,821.

The selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

Free lithographs and full particulars are obtainable from the Land Agent, Longreach, the Land Settlement Inquiry Office, Brisbane, and the Government Intelligence Bureaux, Sydney and Melbourne.

PLATE 316.—M.V. "IDOMENEUS" LOADING FIRST EXPERIMENTAL SHIPMENT OF CHILLED BEEF AT THE BRISBANE ABATTOIR.

[*Photo. by courtesy of Queensland Meat Industry Board.*

The White Man in the Tropics.

The following addresses by Professor A. GRENFELL PRICE, C.M.G., D.Litt., F.R.G.S., of the University of Adelaide, were broadcast over the National Network from Stations 5CL and 5CK on the 11th and 18th July. 1934.

I HAVE been asked to speak to you on the very important and unsolved problem of whether the white man, and particularly the Nordic white man, can settle permanently as a worker in the tropics. So this evening I will tell you about the question in general and what has happened in other lands, and next Wednesday I will deal with an aspect that is so vital to Australians—the problem of whether we, as a white people, can hope to live in and develop the vast, but almost empty, areas of tropical Australia—a region of nearly 1,150,000 square miles. I need hardly emphasise how vital is this question to the Commonwealth. Again and again other nations have called us "dogs in the manger," because of our "White Australia" policy as regards these empty tropics, and only recently the Dean of Canterbury voiced a very usual opinion that we should give North Australia to the Japanese.

But we are not the only white people who are involved in the tropics. Britain, France, and the United States have great tropical possessions, and I found American scientists intensely interested in their own tropical problems in Florida, Panama, and Puerto Rico, and most anxious to hear Australian views.

The truth is that throughout the world leading scientists are disputing over this question of the ability of white people to settle the tropics. Some Americans, such as the well-known Professor Ellsworth Huntington, believe that whites cannot live there permanently, because they are destroyed by the climate. Other scientists, like General Gorgas, of Panama fame, and the Australian Dr. Ray Cilento, consider from the records of Panama and Queensland that the whites can colonise the tropics if they overcome disease. A very great authority, the late Sir Andrew Balfour, took a mid-way position, but at his death he seemed to be swinging towards Cilento's views.

Definitions.

Let us begin by defining White, Settlement, and Tropics. By White we mean people who are white, or nearly white, such as the Europeans, the people of Canada, the United States, and Australia, and the near white peoples of Costa Rica or Cuba. By Settlers we mean people who live, work, and have families for generations in the tropics, and we exclude officials, missionaries, soldiers, and traders who go to the tropics only for a time. By Tropics we mean the earth's surface roughly between 23½ Lat. N. and S., but this covers regions of very varied heat, rainfall, and humidity, and some areas will be far more suitable than others for the whites. We can exclude from our study many regions such as the African or Australian deserts, where no one can live, and many countries such as India or Java, where the whites will never form a working population as the coloured people and their cheap labour are overwhelmingly competitive. Thus we can narrow our inquiry to a few possible areas. The most important of these are North Australia, parts of North, Central, and South America, and the West Indies.

There are three ways in which scientists are attempting to examine the question —the methods of history, of statistics, and of the laboratory. Unfortunately, history is not a very accurate guide, as the progress of medical science has completely changed white prospects in the last few years. The statistical method is not wholly reliable.

It is difficult to secure absolutely satisfactory figures of climate, heredity, &c., even in civilised countries. The laboratory method is also uncertain, for when you test people under artificial conditions of heat or moisture in a laboratory you cannot reproduce the exact conditions which face them when they have to undergo acclimatisation in a tropical zone. By combining the three methods, however, one can find out a great deal about whether the whites are really making progress.

The White Man's Conquest.

The history of the white man in the tropics is very fascinating. From 1500 onwards European nations carried out a great pre-scientific conquest of the tropics. The Portuguese, Spaniards, English, Dutch, French, and other nations poured into tropical Asia, Africa, America, and Australia, and either conquered or destroyed the native coloured peoples. Before very long, however, the tropical diseases and the tropical peoples began to regain their own. In India, Java, Africa, or Mexico the whites continued to hold sway as governors or traders, but each generation returned home, for if they remained they were absorbed like a river flowing into an ocean. In sparsely-inhabited countries, such as the West Indies, the whites destroyed the natives, but, instead of working themselves, the whites brought in negro slaves, and these negroes increased so rapidly that the white masters were soon absorbed. In India, the Portuguese tried the interesting experiment of deliberately breeding a half-caste people, but even this proved impossible, and ultimately the half-castes will be absorbed. Nevertheless, this white pre-scientific wave left some interesting flotsam and jetsam, and many fascinating books have been written on the little communities which have survived. Central America and the West Indies are full of such groups of white people, and, perhaps, we might even call the settlement at Darwin one. In 1932 and 1933 I was lucky enough to examine a number of such communities—Costa Rica in the Central American highlands, where an almost pure Spanish community has survived for 400 years; Jamaica, where a German community came about the same time as the German pioneers of South Australia; and the little and almost unknown island of Saba, where an English-Dutch community has kept almost pure white since the days of the English buccaneers and first Dutch planters—a period of 250 years.

Without going into scientific details, I will simply say that the evidence shows that white men can live and work for generations in the more favourable tropics, provided that they are protected both from disease and from the presence of coloured races, who are usually unhealthy, and are far more dangerous to the white man than any tropical climate. In Costa Rica one found a white Spanish community—artistic and educated—which had kept pure white because the people had been isolated on the plateaux, and because the negro had been excluded until comparatively recent days. This exclusion of the negro is of the utmost importance. Only this week a letter came from an American scientist in Costa Rica to say that the Government so fears the rapid increase of the negro population that it is completely prohibiting negro immigration. It is the same in Saba. There one found a very fair type of pure white English-speaking people who had always done a great deal of their own hard work, but are now in danger, like the Costa Ricans, of being absorbed by negroes.

Control of Tropical Diseases.

After the old pre-scientific invasion of the tropics by the whites had failed, a new and far more promising invasion occurred. From 1890 onwards the British and American scientists learned the control of hookworm, yellow fever, malaria, and many other tropical diseases, and the worst enemies of the whites were partly subdued. On the Panama Canal, for example, "the pest hole of the world," the Americans showed that it was possible to secure a lower death rate than in the most healthy cool temperate countries, and the white death rate to-day is lower than even that of Australia or New Zealand. I spent some three weeks with American scientists in Panama, and saw white Americans who, with very few

vacations in the United States, had carried out the hardest physical labour in the workshops for nearly thirty years. One also saw whites of the second generation who were doing the hard work perfectly well. As for the tropics injuring children an exhaustive examination in 1930 showed that white children in Panama were, on the average and right up to the end of their high school days, of higher standard than similar white children in the United States. The same thing is going on in Southern Florida, where white fruitgrowers are working in a climate that is truly tropical—and the same type of evidence is now coming from the white sugar growers on the Queensland coast, who are actually doing work that the Americans think no white man can possibly perform. We could, however, copy much from the Americans at Panama, for their control of disease, hygiene, and sanitation, and their methods of housing, clothing, and diet are unequalled anywhere in the tropical world. Our figures in Queensland would be even better if we would follow some of their ideas.

We must not, however, be too optimistic because of these successes. What is really happening in Florida and Queensland is that the white man, in particularly favourable regions where economic factors are particularly suitable, is beginning to penetrate the margins of the tropical zone. The great American doctor, General Gorgas—who conquered yellow fever in Cuba and Panama—made the mistake of being over-optimistic because of his successes, and thought quite wrongly that the whites would be able to colonise any part of the tropics. In reality, we are just beginning to understand that we are facing a huge and complex scientific problem, and that the future progress of white people in the tropics depends on a large number of geographic and economic controls. To take only one example, even a small region like Panama has great local varieties of climate, and there are probably in the climate, as affecting white people, a number of factors that are as yet unknown. Similarly, one race is more suited to the tropics than another, and even in a single race there are some individuals who are suited to the tropics, and others who can never acclimatise. This point was strongly emphasised by Dr. Sunstroem, when working in tropical Australia. The Americans are now talking about establishing in Panama a Research Institute to study the process of acclimatisation in various individuals, and a branch of such an institute would be of extraordinary value if founded to study thoroughly the effect of climate on white workers on the Queensland coast.

Soil.

Another vital control is soil. The world is gradually abandoning the old fallacy that almost all tropical soils are fertile. Australia, for example, would have saved a vast wastage in lives and expense had she realised that her Northern Territory soils are some of the poorest anywhere.

Housing.

Isolation is also important. We are beginning to realise that loneliness and inter-breeding have harmed many white communities more than tropical climates, and that small scattered settlements, such as some of those in North Australia, have little chance of meeting with success. Comfort is also of vital importance, particularly for women. One of the greatest hopes for white settlement in the tropics lies in air conditioning the houses. Very soon the white man in the tropics may be able to control the temperature of his dwelling as easily and effectively as the American controls the winter temperature by central heating. Then again, there is the importance of social habits and of food and drink. Many failures in the tropics, particularly British failures, have been partly due to ridiculous clothing, heavy unsuitable diets, and alcoholic excess. Again and again when a young man died of drink in the West Indies, his parents were charitably informed that he had died of fever, and that good old whipping post—the tropical climate—took the blame. Again, we are beginning to realise how dependent the white peoples of the tropics are on temperate policies and markets. The Americans turned

Puerto Rico and Cuba into lands of one crop industry—dependent on the cool temperate sugar markets. Now the United States is refusing to pay a profitable price for sugar, and when the unhappy, starving Cubans explode in riot and revolution, the supposed instability of a tropical people is blamed.

The Colour Barrier.

Most important of all we are beginning to realise that the greatest barrier to white settlement in the tropics is neither climate nor sickness, but the presence of vast masses of coloured peoples, who, as we know from the history of the Kanakas in Queensland, lower the standard of living, create reservoirs of disease, and form the means by which the whites can shirk doing the essential physical work.

From Washington to the Equator, every American scientist I encountered said "You Australians are the wisest people on earth with your 'White Australia Policy'," and this dictum rests on indisputable facts. The health of white people in the Southern United States suffers appallingly from the presence of millions of negroes, while the West Indies and Central America are steadily going black. Jamaica, for instance, which once had thousands of white settlers, is now coloured to 96 per cent.

In this address I have tried to explain the general controls which govern white settlement in the tropics, and I have attempted to give you some idea of the great question in other parts of the globe. Next Wednesday, I will apply some of these principles to our own great problem, and will deal with our strange record of success and failure in the northern tropics, and the difficulties that confront Australians—or any other people—white or coloured—who attempt to settle the North of this great continent.

THE PROBLEM OF NORTH AUSTRALIA.

In my address last week I told you about the general question of white settlement in the tropics. I explained why the white invasion of the tropics failed in the days before modern science, and why the new and scientific invasion of the marginal tropics was meeting with some success. Finally, I tried to show that the future progress of white settlement would depend not merely on the successful combating of tropical climate and disease, but upon many other factors, such as soils, communications, housing, food, and drink, the exclusion of coloured peoples, and economics. To-night, I will apply these general principles to the history and prospects of white settlement in tropical Australia, and will deal with the pre-scientific invasion which failed, the new scientific invasion which appears to be making some headway in Queensland, and the factors which will determine whether any nation, white or coloured, can settle the North of this great continent.

As the Spanish say, "There are tropics and tropics," and we cannot begin to understand the problem of our North unless we realise that we keep a variety of tropics in North Australia. While we possess no equatorial lowlands, like the Congo or Amazon Basins, we have four other kinds of tropics: the tropical trade wind coast of Queensland; the tropical plateaux; the interior deserts of Western Australia, Queensland, and the Northern Territory; and the wet-dry region, that great belt of country, with a monsoonal rainfall in summer and a drought in winter, which runs right around the Australian North and North-West coast. Throughout the world the high plateaux with their cooler climates are the most suitable parts of the tropics for white settlement, but in Australia, out of 46,000 square miles of tropical plateaux over 2,000 feet in elevation, only 14,000 square miles of Queensland plateaux have rainfall and soils sufficiently good to support many whites. Also, we can eliminate completely from the viewpoint of any close white settlement (except, perhaps, for a few temporary mining camps) the whole of the desert or arid regions which have less than 15 inches of rainfall—regions which comprise not less than 700,000 square miles. Thus, we need consider only

the Queensland coastal margin backed by its comparatively small plateaux, and the wet-dry belt of monsoonal country running inland from the North and North-west coast. Australians should never forget that these two regions are of entirely different character. The Queensland coast and plateaux are really promising, for they possess patches of excellent soil and a good and well-distributed rainfall from the monsoons and south-east trades. The Northern and North-western coastlands are entirely different. Most of the soils are poor, leached, and deficient in plant food. During six to eight months the country is almost drought-stricken. In summer, much of it is flooded by terrific rains, some of the rivers rising 50 or 60 feet.

Development of Our Tropical Territories.

Last time I explained how in the days before modern science the whites invaded the tropics, and how in almost every region their penetration failed. From 1824 onwards the whites entered the Australian tropics, partly as squatters and partly as agriculturists on the Queensland and Northern Territory coasts. From 1824 to 1849 the British planted small stations, such as Port Essington in North Australia, and South Australia founded and maintained the Northern Territory as a dependency from 1868 until in 1911, when the Commonwealth took control. From the sixties onwards Australia also saw the development of Northern Queensland by pasturing, agriculture and mines.

This tropical invasion took the usual course. The whites believed that it was impossible for them to work in the tropical climate, and they imported various coloured races which proved hotbeds for diseases that affected the whites in turn. From 1863 to 1891 Australians brought 46,000 Kanakas to Queensland, and from 1874 onwards the Northern Territory permitted the entrance of thousands of Chinese. Few people now realise that in 1876-7 the Japanese Government emphatically refused an official offer by South Australia for an extensive Japanese settlement in the Northern Territory, including free transport for the first 200 Japanese.

A Lost Opportunity.

This influx of coloured people to our continent had the same tragic results as in the West Indies and other parts of the world. We Australians, who had entered into possession of what might have been a marvellous biological laboratory of continental magnitude and free from the worst kinds of tropical sickness, brought in unhealthy types of coloured people who riddled the country and its white inhabitants with tropical disease. In the Northern Territory, during the seventies, white men and Chinese coolies died like flies, while in Queensland the ''dreadful eighties'' saw a Kanaka death rate four times as great as that of the white inhabitants, and a white mortality that became 50 per cent. greater than that of any other State. Yet, even in these circumstances, events showed the fundamental difference between Queensland and North Australia. In both regions pasturing and mining made progress, but while in Queensland the whites and Kanakas established sugar, cotton, fruit, and other tropical industries, in the Northern Territory with its seasonal rainfall, poor soil, isolation and pests, such as the white ant and rat, the whites and Chinese met with no success. The close of the century saw North Australia stagnant save for cattle, mining, and pearling, and for a plantation system of agriculture—as usual unhealthy—established on the Queensland coast.

A Scientific Invasion.

Yet, while the pre-scientific invasion failed in Australia as in other countries, a scientific invasion from 1900 onwards has made progress, as is the case in Panama and in Southern Florida, which latter is a moderately tropical region very like the Queensland coast. Under the much-criticised White Australia Policy the nation deported the Kanakas, and by a health campaign against hookworm, leprosy, malaria, and other diseases, made the health and vital statistics of Queensland as good, or better, than those of any other State. To the utter astonishment of the

scientists of all nations, we established a working population of 150,000 white people in North-Eastern Queensland—the largest population of working Nordics in any part of the tropics. There is, of course, the question of alien Italian penetration in the most northern sugar districts, and it is very significant that in these areas foreigners or naturalised subjects number no less than 43 per cent. The Sugar Committee of 1931 reported, however, that the flow of alien immigration had declined; that the problem was passing through a transitory stage; and that satisfactory communities would be evolved out of the communities in the far North. White Australians of British extraction have shown that they can do all the heavy labour in sugar and other industries, and before the depression they were bringing the costs of sugar production down towards the cost of production in coloured labour countries. In this respect, mechanical improvements will be of vast importance. In Florida and Jamaica I saw machinery which will eliminate almost all the hard manual labour in the sugar industry. While, however, this machinery will improve the prospects for white workers, it will spell stark naked tragedy for the wretched coloured peoples whom the white man has forced into one-crop industries.

Remarkable Physical Phenomena.

In 1924 a scientific investigation of certain Queensland towns disclosed remarkable phenomena. Contrary to all previous beliefs, white residents, even of the second and third generations, seemed to be healthy and strong. Tropical-born women averaged larger families than immigrant women from the cool temperate zone, and the most healthy people were those who did hard manual work. There remain two dangers in Queensland. First, the experiment is very new, and we are by no means certain of the continued effects of climate. Dr. Cilento considers that there is beginning to be a very definite type of North Queenslander or tropical-born Australian who moves slowly and conserves his muscular heat-producing energy in every possible way, but that this type is not lacking in muscular strength, while his endurance is equal in his own circumstances to that of the temperate dweller in his. Sir George Buchanan, in his great report on the Northern Territory, produced evidence to the effect that white labour there was from 10 per cent. to 35 per cent. inferior to that in the temperate zone.

The second danger in Queensland is that the white industries are uneconomic in the sense that their costs of production are far above world average, and that Australia is being forced to pay inordinately high prices for such products as sugar and bananas to allow the white population that standard of living which is essential if whites are to survive in the tropics. Yet, Queenslanders can justly argue that their industries are now no more uneconomic than most of the tariff-propped industries of temperate Australia. As Keynes and other economists confess, the tariff-mad and nationalistic nations are boxing themselves in water-tight economic compartments, and we must all face artificial industries and a lower standard of life.

Cattle-raising—A Probable Solution.

While the whites have succeeded in tropical Queensland, in the rest of North Australia, save in cattle, they have met with practically no success. It is a matter of sympathy that in the Northern Territory, for example, the figures of deaths, illegitimate births, serious crime, suicides, and drunkenness are far higher than those for any other division of the continent. Such figures are not necessarily due to the tropical climate, for isolation, a mixed population, poor diet, and frontier conditions take their toll from the unfortunate people. Nevertheless, it is significant that South Australia and the Commonwealth fruitlessly expended enormous sums of money in vain efforts to develop a huge area which now contains less than 4,000 whites. From 1911 to 1930 the Federal Government spent over £11,000,000, and in 1928-29 alone made a loss of £576,000, or about £150 per white person, while under Federal control the costs of working the Northern and Central railways

have exceeded the revenue by nearly 100 per cent. It is small wonder that American scientists, in a recent world survey, have pointed out the utter futility of Australia wasting vast sums in attempting to develop agriculture and close settlement in her North Coast lands of poor soil and uncertain monsoonal rains. The only real hope lies in the cattle country which runs across the continent from Queensland to Western Australia between the central deserts and the coastal regions. Here, on stock routes and water supplies, we should spend as much as we possibly can, and it is splendid to know that the motor transport unit, which the Federal Government is subsidising, may solve the railway problem, and is already reducing costs by 50 per cent.

Segregation of the Native Race.

Outstanding questions of North Australia are the aboriginal and half-caste problems. It is now generally recognised that we should try to segregate the blacks, where it is possible, for example, in Melville Island and Arnheim Land. As regards the thousands of aboriginals who have access to settled country, the best we can hope is to absorb them as the Americans have absorbed the Red Indians. It is interesting to note that a recent Vice-President of the United States was legally an Indian—a ward of the State. The Australian half-castes are now increasing at the rate of 800 per annum, and one believes that the Protector at Darwin is right in trying to marry these half-castes to one another, and the surplus girls to white people, rather than to force them back to the aboriginal camps.

Successful Tropical Settlement.

In conclusion, one would say that history and science provide the answer to those who ignorantly criticise our empty North and the policy of White Australia. The only parts of our tropics which any nation—white or coloured—can hope to settle closely are the coasts and highlands of Eastern Queensland, and here we have already planted successful white industries and a white population which is apparently teaching the most extraordinary and unexpected lessons to the whole world. The remainder of North Australia is at best a cattle country. We have poured out £17,000,000 in unsuccessful attempts to settle one portion—the Northern Territory. Agriculture, with coloured Chinese labour, has been an utter failure, and the Japanese very wisely refused our invitations when we invited them in. If, despite such a record, the Dean of Canterbury, or Dean Inge, or Mr. Beverley Nicholls continue their criticisms of our supposed selfishness, Australians might humbly ask them to visit the West Indies, and study, as I did recently, the tragic problems of race, health, and economics, which were created by the importation of negro slaves.

Scientific Research Demanded.

What is the practical lesson of these two addresses? It is that the Australian Governments of all parties should face their problems in the tropics, not as questions of politics, but of science, and that before more money is lost in attempts to plant white settlers and tropical industries they should prepare the way by careful scientific research. To take only one problem—that of agriculture in the Northern Territory—almost every one of the few soil analyses have been disappointing, and even black soil which I brought down from the Adelaide river flood plains proved deficient in potash. Yet, despite the advice of Sir George Buchanan, the Government, only a few years back, again attempted to foster by subsidy a one-crop peanut industry on soils which a later soil analysis proved unsatisfactory. We now know that adequate scientific work in the Northern Territory could have saved the nation a loss of millions of pounds, and the people of Australia have the right to ask that no more money be wasted without the most careful and impartial examination by highly-trained scientists.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Friesian Cattle Society, production charts for which were compiled for the month of October, 1934 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORN.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Lucky II. of Windella	J. Phillips, Wondai	14,152·58	592·29	Daisy's Westbridge of Glenthorn
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Springleigh Primrose 2nd	Moller Bros., Boonah	9,647·9	388·203	Red Knight of the Cedars
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Champion 12th of Oakvilla (365 days)	H. Marquardt, Wondai	14,717·15	595 498	Victory of Greyleigh
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Springleigh Buttercup 2nd	Moller Bros., Boonah	8,310·35	316·64	Red Knight of the Cedars
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.			
Euroa Carnation	H. L. Lindenmayer, Binjour	7,272·5	265·244	Swagman of Clonogan
College Granny 4th	Queensland Agricultural High School and College, Gatton	6,500·22	253·936	Duplex of Greyleigh
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.			
Lady Primrose 2nd of Blacklands	A. Pickels, Wondai	10,278·55	350·834	Fussy's Monarch of Hillview
College Buttercup 2nd	Queensland Agricultural High School and College, Gatton	6,475·18	333·449	Fussy's Kitchener of Hillview
Euroa Clorine	H. L. Lindenmayer, Binjour	7,174·75	265·599	Swagman of Clonogan
College Mayflower	Queensland Agricultural High School and College, Gatton	6,961·17	253·436	Premier of Hillview
Euroa Remona	H. L. Lindenmayer, Binjour	7,012·75	240·232	Swagman of Clonogan
College Molly 2nd	Queensland Agricultural High School and College, Gatton	5,543·99	237·021	Duplex of Greyleigh

JERSEY.				
MATURE (OVER 5 YEARS), STANDARD, 350 LB.				
G. N. Diva	Cox Bros., Maleny	6,876 6	433·551	Retford Mendels Noble
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD, 330 LB.				
Langside Quip (365 days)	G. W. Young, Inverlaw	8,335·75	512·856	Masterpiece Yeribee of Brucevale
Kelvinside Idol Tidy	J. & R. Williams, Crawford	6,353·75	428·403	Kelvinside Fleurs Benedictine
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD, 270 LB.				
Oxford High Girl	E. Burton & Sons, Wanora	6,086·76	324·005	Trinity Ambassador
Trecarne Rosette 3rd	T. A. Petherick, Lockyer	4,839 47	270·558	Trecarne Golden King
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 250 LB.				
Langside Pattibelle	G. W. Young, Inverlaw	5,365·65	279·754	Masterpiece Yeribee of Brucevale
Brooklands Forward Lillian	Wallace Bishop, Kenmore	5,546 5	271·443	Forward of Brooklands
College Rhoda	Queensland Agricultural High School and College, Gatton	4,443·02	255·286	College Silverside
Langside Thelma	G. W. Young, Inverlaw	4,968·1	248·957	Masterpiece Yeribee of Brucevale
College Florette 2nd	Queensland Agricultural High School and College, Gatton	4,141·3	241·826	Burnside Renown
FRIESIAN.				
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD, 330 LB.				
Ryfield Maggie 2nd	J. P. Larson, Miriam Vale	9,868·25	383 988	Ryfield Butterman 3rd
Ryfield Dinah 4th	J. P. Larson, Miriam Vale	8,832·	379·446	Ryfield Butterman 3rd
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD, 290 LB.				
St. Athans Honeysuckle	W. H. Grams, Upper Tent Hill, Gatton	8,637·98	326·6	Glenvale Dutch Oak
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD, 270 LB.				
Rockview Hope	J. P. Larson, Miriam Vale	6,576·	283·854	Noreens Dekol
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
St. Athans Double Dutch	W. H. Grams, Upper Tent Hill, Gatton	7,205·33	254·410	Glenvale Dutch Oak

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from 3rd January, 1935, a fifteen minutes' talk, commencing at 7.15 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for January, February, and March, 1935:—

SCHEDULE OF LECTURES

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Thursday, 3rd January, 1935—''Rose Culture,'' by H. Barnes, Director of Fruit Culture.

Tuesday, 8th January, 1935—''Some Notes of a Travelling Scholar in Plant Breeding,'' by Dr. L. G. Miles, Plant Breeder.

Thursday, 10th January, 1935—''Improving the Quality and Productiveness of Fruit and Fruit Trees,'' by H. Barnes, Director of Fruit Culture.

Tuesday, 15th January, 1935—''The Place of Plant Breeding in Agriculture,'' by Dr. L. G. Miles, Plant Breeder.

Thursday, 17th January, 1935—''The Trend of Agricultural Economics,'' by Hon. Frank W. Bulcock, M.L.A., Secretary for Agriculture and Stock.

Tuesday, 22nd January, 1935—''The Problem of Youth—The Call of the Land,'' by J. F. F. Reid, Editor of Publications.

Thursday, 24th January, 1935—''A New Deal for the Farmer,'' by J. F. F. Reid, Editor of Publications.

Tuesday, 29th January, 1935—''Frost Prevention by Orchard Heating,'' by H. Barnes, Director of Fruit Culture.

Thursday, 31st January, 1935—''Wheat in Queensland,'' by H. W. Ball, Assistant Experimentalist.

Tuesday, 5th February, 1935—''The Rural Revival in Britain—What it Means to the Australian Producer,'' by J. F. F. Reid, Editor of Publications.

Thursday, 7th February, 1935—''Grading Cotton,'' by R. W. Peters, Cotton Experimentalist.

Tuesday, 12th February, 1935—''Winter Legumes and other Fodders,'' by C. T. White, Government Botanist.

Thursday, 14th February, 1935—''Some Notes on Our Inland Pastures,'' by S. L. Everist.

Tuesday, 19th February, 1935—''Management of Paspalum Pastures,'' by C. W. Winders, B.Sc. (Agric.).

Thursday, 21st February, 1935—''The Cultivation of Lucerne,'' by A. E. Gibson, Director of Agriculture.

Tuesday, 26th February, 1935—''The Effects of Fertilizers on the Quality of Tobacco Leaf,'' by W. J. Cartmill, B.Sc.

Thursday, 28th February, 1935—''Snapping Cotton,'' by R. W. Peters, Cotton Experimentalist.

Tuesday, 5th March, 1935—''The Activities of Sheep and Wool Branch with Special Mention of the Farmers' Wool Scheme,'' by J. L. Hodge, Instructor in Sheep and Wool.

Thursday, 7th March, 1935—''Sheep Licks,'' by J. L. Hodge, Instructor in Sheep and Wool.

Tuesday, 12th March, 1935—''Winter Pastures,'' by C. W. Winders, B.Sc. (Agric.).

Thursday, 14th March, 1935—''Grape Culture,'' by H. Barnes, Director of Fruit Culture.

Tuesday, 19th March, 1935—"Some Remarks on Animal Nutrition," Part I., by E. H. Gurney, Agricultural Chemist.

Thursday, 21st March, 1935—"Some Remarks on Animal Nutrition," Part II., by E. H. Gurney, Agricultural Chemist.

Tuesday, 26th March, 1935—"Observations on Tobacco Fertilizer Trials," by W. J. Cartmill, B.Sc.

Thursday, 28th March, 1935—"Expanding our Export Trade," by J. F. F. Reid, Editor of Publications.

NOTICE TO SUBSCRIBERS.

SPECIAL AND IMPORTANT.

Under the Commonwealth Postal Regulations it is NO LONGER PERMISSIBLE to indicate the expiry of subscriptions with a BLUE CROSS on the first page of the Journal. So in the future that reminder will NOT appear.

The need for the strictest economy makes any other form of reminder at present impracticable. THE ONUS OF REMEMBERING THE DATE OF EXPIRY OF, AND RENEWING THE SUBSCRIPTION PROMPTLY IS, THEREFORE, PLACED ON EACH SUBSCRIBER.

As about 1,000 subscriptions expire each month, the cost of a postal reminder is, in present circumstances, prohibitive. Readers will, therefore, appreciate that fact, and will, no doubt, help us to retain their names on our mailing list by kindly noting the date of payment of their subscriptions and, on expiry, sending in their renewals at once.

Instead of just sending the annual subscription—one shilling—along, it is suggested that, when renewing, they do so for two or three years, or even a longer term. For instance, FIVE SHILLINGS would keep a name on our subscribers' register for FIVE YEARS.

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Readers renewing their subscriptions should USE THE ORDER FORM on another page, which should be filled in FULLY and CORRECTLY. Renewals by letter do not as a rule give the essential information, thereby causing unnecessary waste of time and much inconvenience. The Form is also our record, and orders which come by letter require special handling to adapt them to our card recording system.

When an address on the Order Form is not that to which the Journal has hitherto been sent, attention should be called to the new address, and the former address given. This assists us to identify subscribers, of whom we have many of the same name, often in the same district, as well as in different parts of the State.

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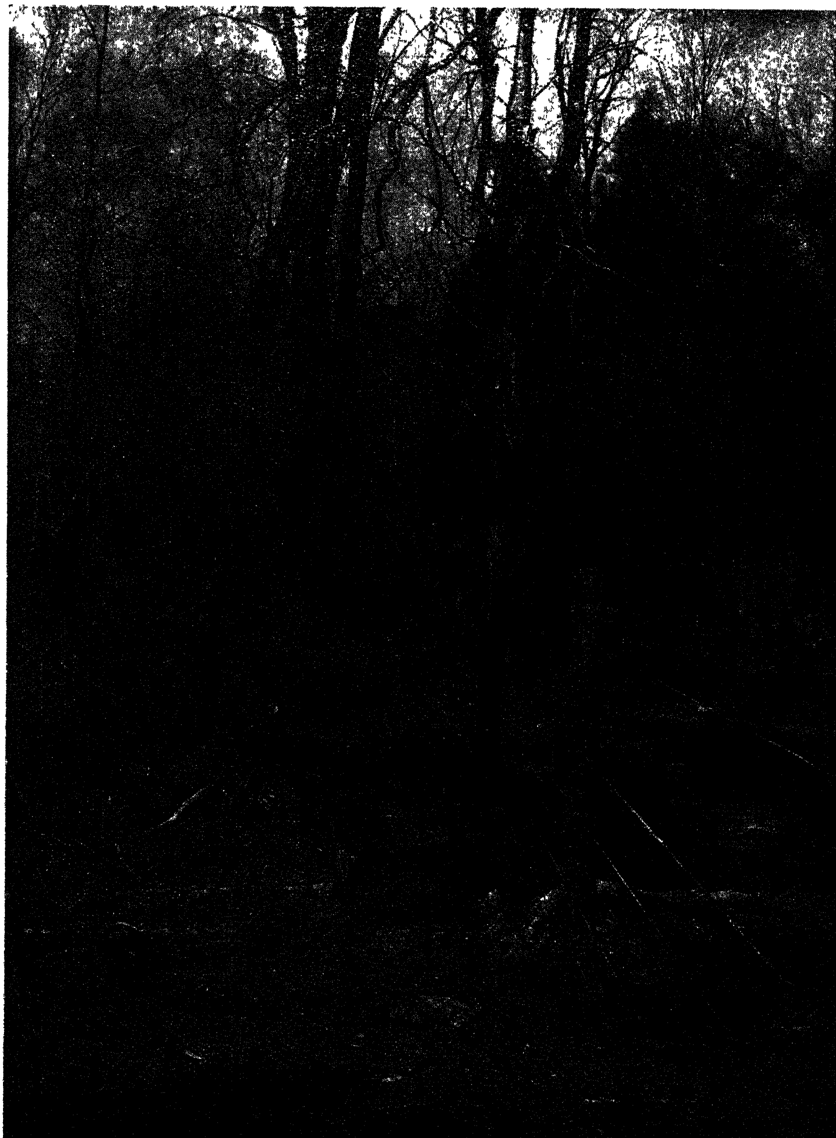

PLATE 317.
Stock-proof Fence and Ringbarking on a Selection in the Roma District.
[*Photo., J. A. Lunn.*

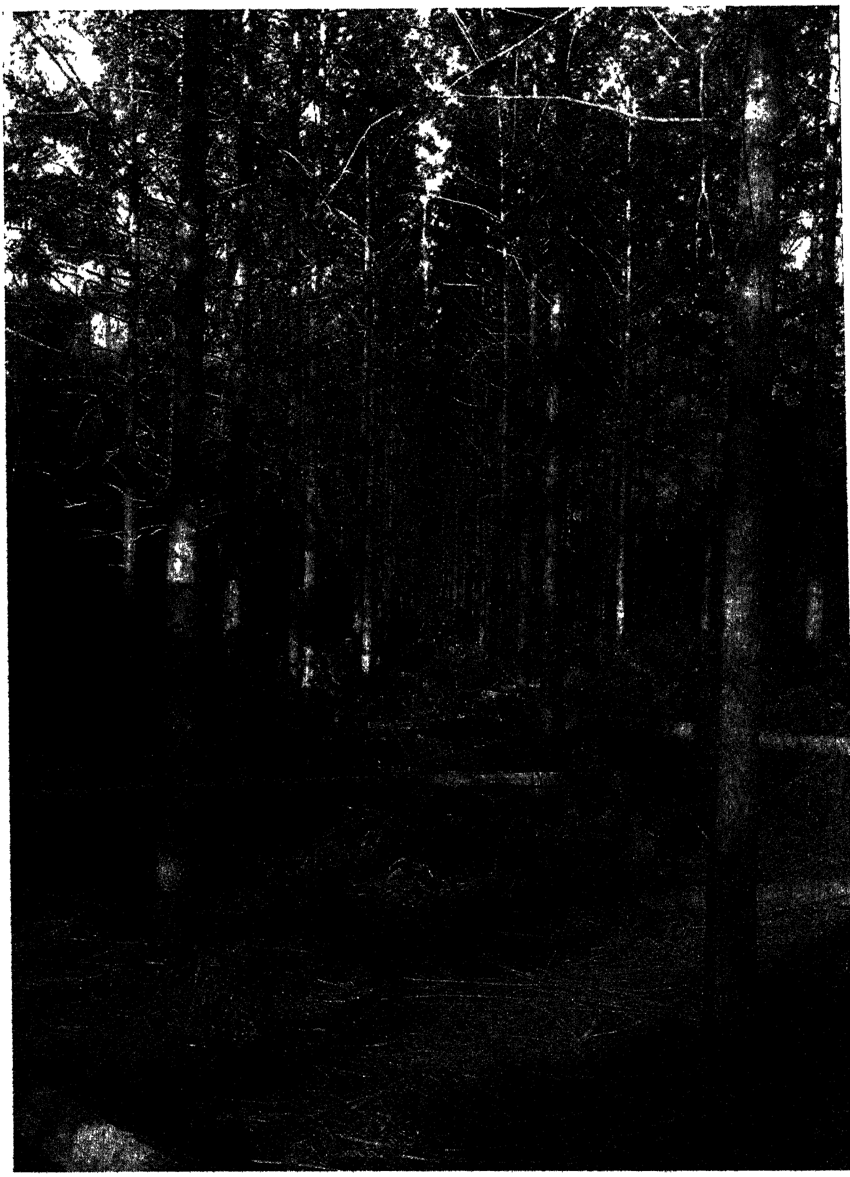

Plate 318.
Silky Oak in Plantation, showing First Thinning. Trees ten years from planting.
[*Photo., J. A. Lunn.*

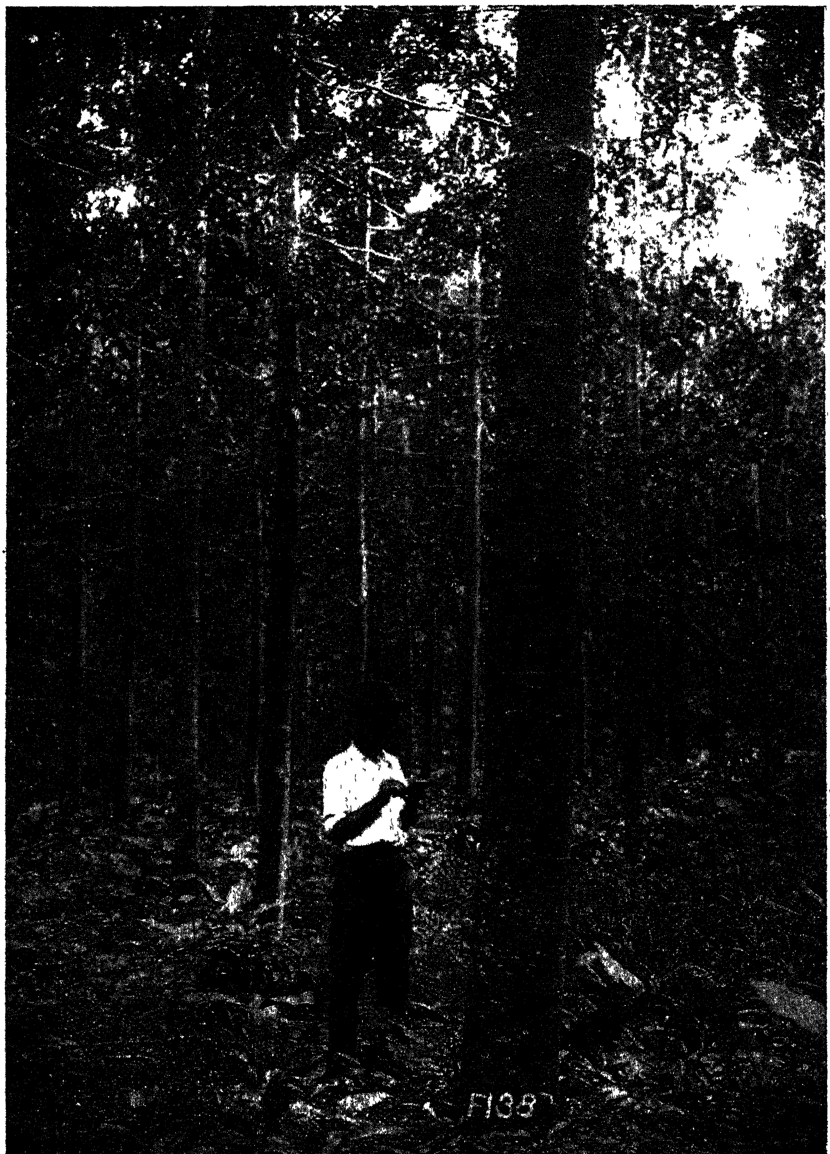

PLATE 319.

A Queensland Kauri Pine Plantation, seventeen years old. This species makes a good plantation tree, and is used to the greatest extent permitted by seed supplies, which are difficult to obtain.

[*Photo., J. A. Lunn.*

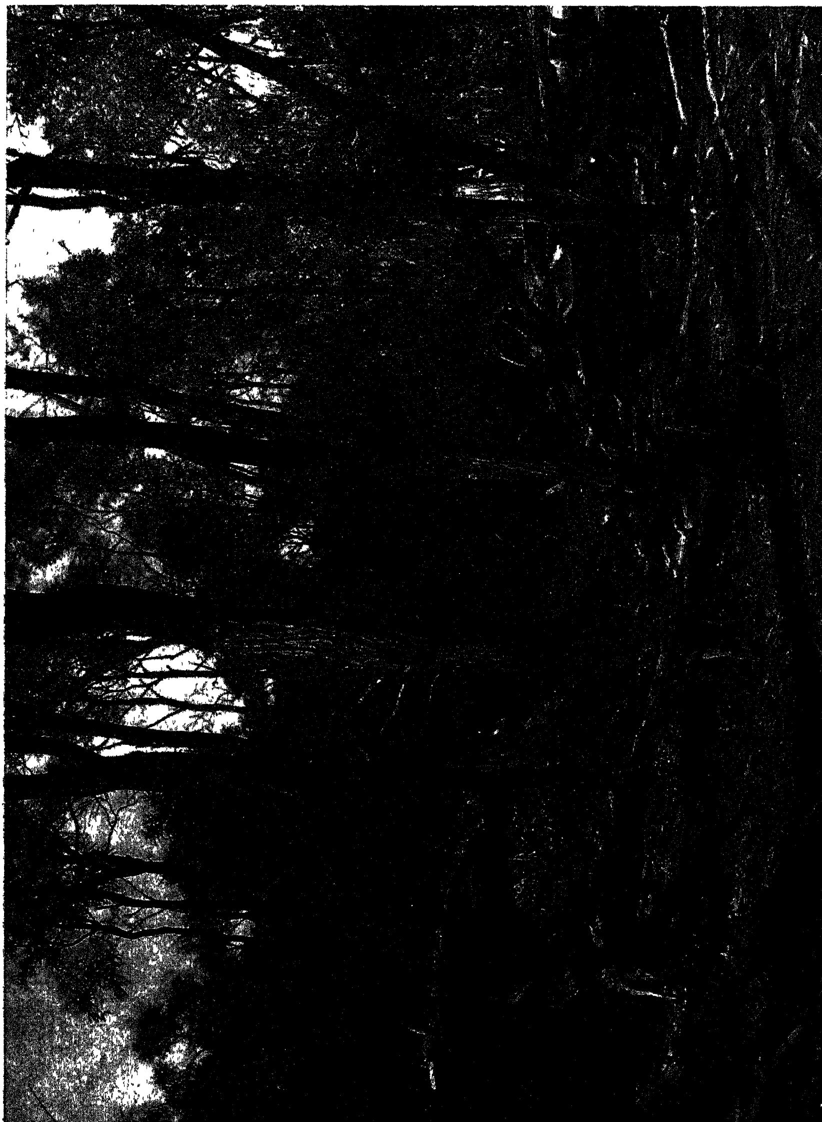

PLATE 320.—GREEN BRIGALOW AND BELAH COUNTRY, SOUTH-WESTERN QUEENSLAND.

[*Photo., J. A. Lunn.*

PLATE 321.—BRIGALOW AND BELAH COUNTRY, BEFORE RINGBARKING. [Photo., J. A. Lunn.

PLATE 322.—HEAVY COATING OF GRASS ON COUNTRY RINGBARKED TWO YEARS AGO, MARANOA DISTRICT.

[*Photo. by J. A. Lunn.*

PLATE 323.—NATURAL REGENERATION OF IRONBARK (*E. paniculata*), SHOWING FIREBREAK.

[*Photo. by J. A. Lunn.*

Plate 324.—Forestry in Queensland—Plantation of Tallowwood (*Euc. microcorys*) Four Years Old.

[*Photo. by J. A. Lunn.*

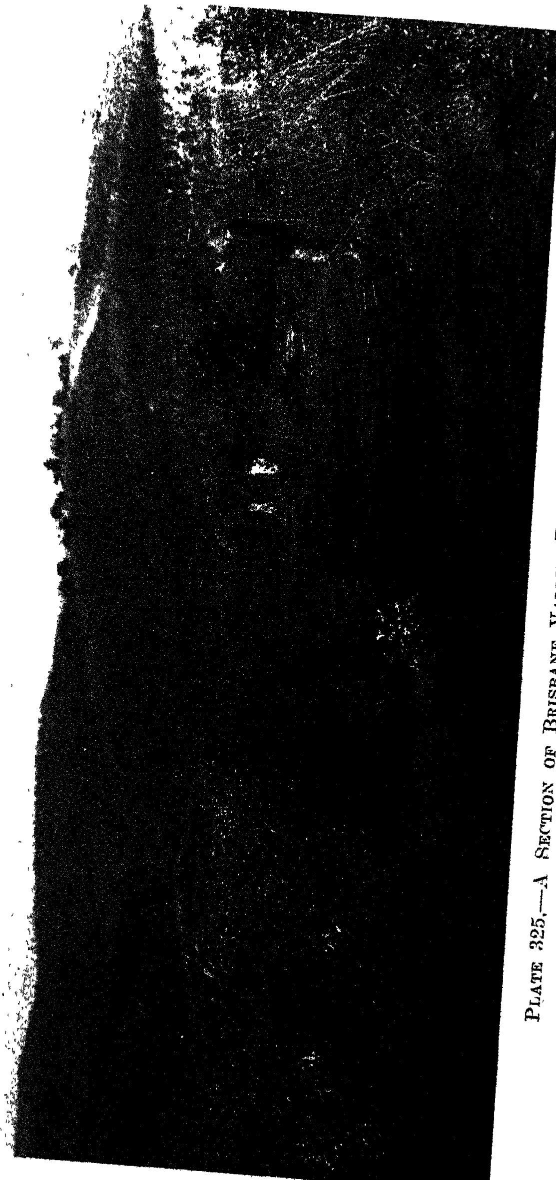

PLATE 325.—A SECTION OF BRISBANE VALLEY DISTRICT FORESTRY PLANTATIONS.

[Photo. by J. A. Lunn.

PLATE 326.—CLEARING LINE FOR A MARSUPIAL-PROOF FENCE THROUGH BRIGALOW AND BELAH SCRUB IN THE TARA DISTRICT.

[Photo. by J. A. Lunn.

PLATE 327.—HOOP PINE PLANTING STOCK IN NURSERY, SUB-DEPARTMENT OF FORESTRY, QUEENSLAND.

[*Photo. by J. A. Lunn.*

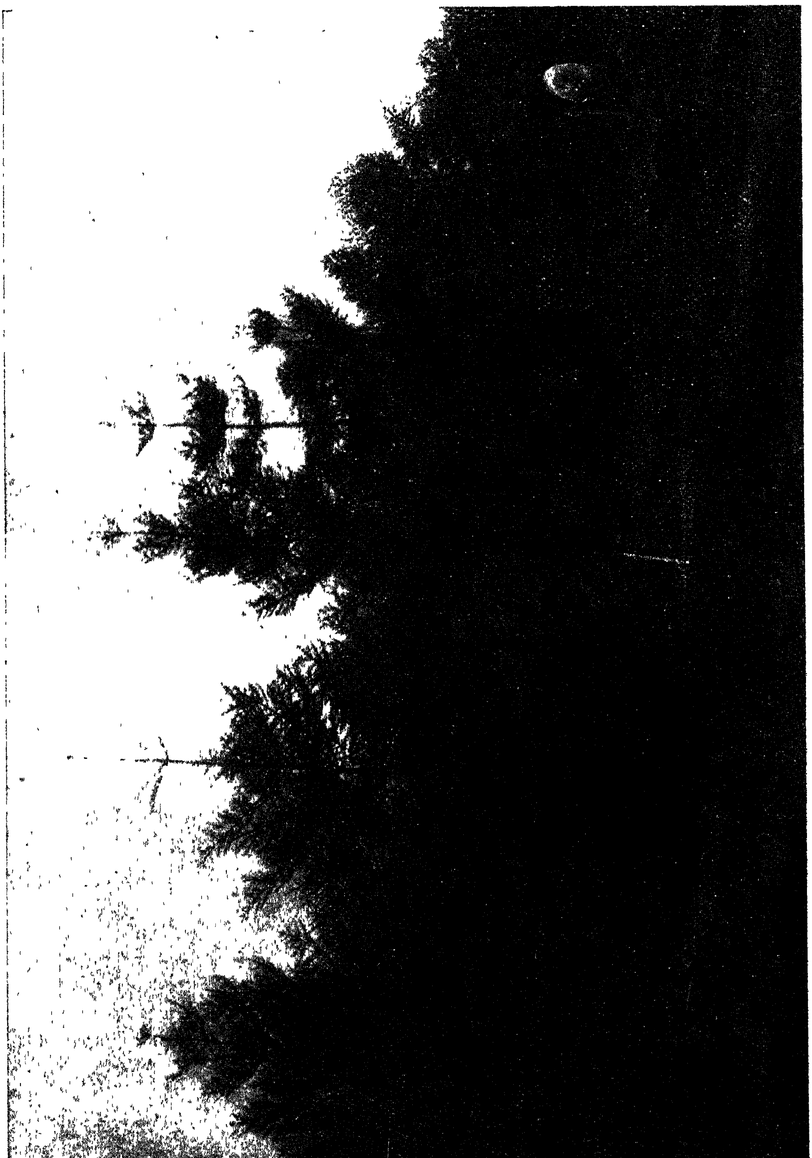

Plate 328.—Young Hoop Pine Plantation, Seven Years Old.

[Photo., J. A. Lunn.

PLATE 329.—BRIGALOW AND BELAH SCRUB RINGBARKED EIGHTEEN MONTHS AGO NOW CARRYING A HEAVY COATING OF NATURAL AND NUTRITIOUS GRASSES.

[*Photo., J. A. Lunn.*

Answers to Correspondents.

BOTANY.

Replies selected from the outward mail of the Government Botanist, Mr. Cyril White, F.L.S.

Poisonous Plants Identified.

H.C. (Mackay)—Your specimens have been determined as follows:—

1. *Crotalaria* sp., a species of Rattlepod. All these plants are to be looked on with suspicion, although, generally speaking, our experience in Queensland is that stock rarely touch them in sufficient quantities to cause trouble.
2. *Lantana camara* var. *sanguinea*, the Red Lantana. Very abundant in parts of Queensland, and causes the trouble known as "Pink Nose," no doubt familiar to you.
3. *Trema orientalis*, a close ally of the Poison Peach or Peach-leaved Poison Bush. The present form grows into a medium-sized tree, and is very common in coastal localities. We have not heard of it causing trouble in any way, therefore do not think this plant can be looked on as the cause of the trouble in this case.
4. *Asclepias curassavica*, Red Head or Milky Cotton-bush. A very common weed in many parts of Queensland. It is poisonous, though, on the whole, our experience has been that stock rarely eat it in sufficient quantities to cause trouble.
5. *Clerodendron floribundum.* A shrub or small tree common in parts of coastal Queensland. We have not heard a common name applied to it. It is not known to be poisonous or harmful in any way.
6. *Glochidion Ferdinandi.* A small tree very common in coastal Queensland, particularly as second growth in paddocks. It is not known to be poisonous or harmful in any way. We have not heard a very distinctive local name for it.

Of the above plants Nos. 1, 2, and 4 come under suspicion, and, if possible, should be eradicated from the property.

"The Tree of Heaven."

C.B. (Pine Mountain)—

The shrub contained neither flowers nor seeds, but we think there is no doubt it represents *Ailanthus glandulosus*, the "Tree of Heaven." The bark and roots contain a poisonous principle and this probably extends to the leaves; although the tree is very common in cultivation and has run out in some places, we can find no reference, either in Australia or abroad, to the leaves having proved harmful or poisonous to cattle. In view, however, of the known poisonous character of the plant it would be just as well to eradicate it from places to which cattle have access. The poisonous properties of the plant are said to be a cause to a great extent of chronic gastritis. Vomiting, pains in the back, difficult urination, and persistent constipation are said to be features of Ailanthus poisoning.

Flame Tree.

E.H. (Childers)—

The specimen represents the Flame Tree (*Sterculia acerifolia*), a native of Northern New South Wales and coastal Queensland. It is moderately common in come coastal rain forests or vine scrubs, and when one is at a height such as Tamborine Mountain and the McPherson Range, looking down on the valleys at this time of the year one can see bright patches of colour where this tree is in flower. It is certainly an exceedingly handsome tree, but it varies a lot in its flowering qualities. Some trees at the present time of the year are one mass of flowers, others have somewhere about an equal proportion of flowers and leaves, and others are bearing practically all leaves and very few flowers.

Wild Verbena.

INQUIRER (Brisbane)—

Your specimen represents *Verbena venosa,* commonly known in Queensland as the Wild Verbena, a native of the Argentine, now a common naturalised weed in many parts of Queensland and New South Wales. It seems to have been much on the increase in Queensland during the last two or three years, and along many roadsides and railway lines we have seen it crowding out other plants and grasses. If it is invading the native pasture in the Burnett district it is certainly serious, as it is a very dominant weed and would eventually run out the grasses and pasture plants—practically speaking, ruining the paddocks.

Plants from Winton District Identified.

R.C. (Winton)—

1. *Sporobolus actinocladus,* a common grass in parts of Western Queensland. We have not heard a common name applied to it.
2. *Goodenia glauca* (?). Better material required to be certain. Species of Goodenia are quite common in Queensland, both on the coast and inland. They are probably quite useful herbs in the mixed native pasture, though we cannot say we have actually seen stock eating them to any extent.
3. *Chloris scariosa.* One of the Star grasses or Windmill grasses. A very pretty species, though we have not heard a distinctive name given to it.
4. *Capsella Bursa-pastoris,* Shepherd's Purse. We note you say that this plant has just appeared in your locality. It is very common in Queensland, but mostly occurs as a farm weed. It belongs to the family Cruciferae which contains the Turnips and Mustards, and like other members of that family, if eaten in quantity by dairy cattle, it taints milk very badly.
5. *Abutilon* sp., a plant of the Mallow family. The genus Abutilon is a fairly large one in Queensland, and the members are rather difficult to determine except with very complete material. The genus, we think, is rather in need of revision.
6. *Bassia* sp., Gidgee Prickly Saltbush.
7. *Euphorbia Stevenii,* Bottle Tree Caustic. This is generally regarded as poisonous, though so far as we know actual feeding tests have not be carried out with it. The characters of Euphorbia poisoning as recorded by practical stockmen, both in Queensland some of the other States, are that the head and neck of affected animals swell very considerably, and if this swelling is pierced an amber-coloured fluid exudes. If pierced in time the life of the animal is usually saved.
8. *Helichrysum podolepideum.* A fairly common weed in parts of Western and Central Queensland. It is not known to be poisonous or harmful in any way.
9. *Pterigeron adscendens.* This and an allied plant have been suspected of poisoning stock, but no feeding tests have been carried out with them. Chemical analysis in most of these cases yields very little result, and the only way of finding out whether these plants are poisonous or not is by means of feeding tests.
10. *Capparis nummularia,* a plant of the Caper family. It is not known to be poisonous or harmful in any way. I have never heard it called Fuchsia Bush. It is a pity to call it Fuchsia Bush as this confuses it with another plant—namely, *Eremophila maculata,* with red, or more rarely yellow, spotted flowers. This latter is probably familiar to you. It is undoubtedly poisonous, containing a prussic acid yielding glucoside, but like other prussic acid yielding plants it is sometimes eaten in large quantities without any ill effects following. The effects of plants of this character are most marked on tired or travelling stock.
11. *Scaevola* sp. Could you send better material of this species, pressed if possible? We do not seem to have it in our collections.
12. *Swainsona Burkei,* Ladies' Pockets. Another interesting plant. Would it be possible to send fruiting material of this?
13. *Trichodesma zeylanicum,* Kangaroo Bush. We have never seen stock eat this, although they may nibble at it at times. The plant has been suspected of being poisonous, but we think on insufficient evidence.

Chaff Burr.

Inquirer (Winton)—

The specimen represents *Achyranthes aspera,* the Chaff Burr or Prickly Chaff Flower, a weed widely spread over tropical and sub-tropical parts of India, the Malayan region, Australia, and the islands of the Pacific. It is quite common in parts of Queensland and ranges from the sea beach to the far interior. Though its prickly fruits seem to lend themselves to distribution, we cannot say that we have seen the plant anywhere as a serious pest. In India the plant is looked upon as highly medicinal, being used in the treatment of various diseases. The leaves, like those of other members of the Amaranth family (Amarantaceæ) in the East, are sometimes used as greens. The plant does not possess any poisonous properties and would probably be eaten by stock, although we have had no experience with it in this direction.

Plants from Cairns District Identified.

J.A.H. (Cairns, N.Q.)—Your specimens have been determined as follows:—

Flannel Weed, *Pterocaulon cylindrostachyum.* The name Flannel Weed is mostly applied in North Queensland to a rather different plant—a species of Sida, namely *Sida cordifolia.* We know of no economic uses for either of them except that the Sida plant is said to be readily eaten by stock, although the numerous hairs with which it is covered might cause digestive troubles.

Scented Weed, *Pterocaulon glandulosum.* We note what you say about this plant being a possible repellent for insects. See notes under next specimen.

Camphor Weed, *Hyptis suaveolens.* A very common weed in North Queensland, a native of tropical America. It was first noticed about Townsville some twelve years or so ago, but is now very abundant through the whole of the North. The stems and leaves are sometimes strewn around themselves by fishermen, who state that the plant has a definite value for keeping away the attacks of sand flies, mosquitoes, and other insects. If the oil were distilled from this plant, it would probably have somewhat the effect of citronella and be merely a repellent. We do not know that it would have any definite lethal properties; this could only be tried by experiment.

Native tree, said to be quite ornamental and good for bees, is *Persoonia falcata,* one of the Geebungs.

Corky Bark, *Coelospermum reticulatum,* a native tree very common in many places, widely distributed in Queensland, but for which we have not heard a definite local name.

Yam, *Dioscorea bulbifera* var. This we think is the common ornamental yam grown in Queensland. Have you ever tried eating them? We once wrote to Mr. Burkill, when he was Director of the Botanic Gardens at Singapore. He is a great authority on yams and we asked him about the varieties of *Dioscorea bulbifera.* He said they varied very considerably in regard to their edible qualities from pleasant to dangerous. Cutting the yams open and seeing if they turn brown quickly or not he regarded as quite a good sign. When in doubt his advice was to cook in small quantities and taste discreetly.

Perennial Rye.

J.M.C. (Condamine)—

The specimen has been determined as the Perennial Rye (*Lolium perenne*). This, we think, is undoubtedly the best of the Rye Grasses owing to its perennial character. So far as our experience in Queensland goes, however, it does not seem to have succeeded outside of cultivated areas. However, we think it well worth trying with the Burr Trefoil and White Clover on your box and sandalwood country. The addition of the superphosphate you are using should certainly increase the clover and trefoil content of the pasture. Did the grass grow through last summer with you or did it die out and come again this year? Even the true perennial strains of Rye Grass, we are inclined to think, may die out in the Queensland summer, particularly when the plants are pastured, although they may come again the following season. Have you tried the perennial strain of Prairie Grass (*Bromus marginatus*)? Seeds of this and the Rye Grass are best sown during the autumn months.

Gympie District Plants Identified.

E.R.L. (Lagoon Pocket, via Gympie)—

Your specimens have been identified as follows:—

1. *Medicago denticulata*, the Burr Trefoil, a very valuable winter and early spring fodder. Stock seem to prefer the plant when it is dying off rather than when it is green and luxuriant, but even the dried plant covered with its little seed-pods is quite nutritious. The burrs that follow the seed-pod are rather objectionable in the belly wool of sheep, but the good qualities outweigh the bad.
2. *Solanum nigrum*, the Black Nightshade, called "Blackberries" by children. The plant, however, is not related in any way to the true Blackberry. The green fruits contain a poisonous alkaloid, solanin, which tends to disappear as the fruits ripen up. Hence the ripe fruits are freely eaten by children without any ill-effects following.
3. *Stachys arvensis*, commonly known as Stagger Weed or Wild Mint. It is not to be confused with the Wild Mint that has attracted so much attention in the Press of recent years, and is a bad weed on parts of the Darling Downs. The present plant, as its name indicates, causes "staggers" or "shivers" in working stock. Ordinary paddock or resting stock, however, feed on the plant with impunity, and for dairy cattle, calves, &c., it is quite a good fodder.
4. *Silene gallica*, French Catch-fly, a native of Southern Europe, now a common naturalised weed in most warm temperate countries.
5. *Erythræa australis*, Centaury, a plant of the Gentian Family (*Gentianæ*); used by many people as a tonic.
6. *Euphorbia peplis*, Spurge. The milky sap that this plant contains is sometimes used for drying up sores, and is said to have curative properties.
7. *Trifolium procumbens*, Hop Clover. An annual Clover; a native of Southern Europe now naturalised in most warm temperate countries. It is moderately common in Southern Queensland during the winter and spring months, dying out on the approach of summer.
8. *Striga parviflora*. Plants of this genus are mostly parasitic on grasses. Some of the species are quite common in Queensland as parasites of sugar-cane.
9. *Trifolium glomeratum*, Cluster Clover. One of the best of the annual Clovers and worth encouraging.

W.G.B. (Amamoor, Mary Valley Line)—

1. *Fumaria officinalis*, Fumitory. A common European weed now common as a naturalised alien in most temperate countries.
2. *Chenopodium triangulare*, Fish Weed, a native plant of the Saltbush Family. It is a very common weed in many places. Stock seem to eat it readily enough when it is dying off and made into hay, though they do not eat the growing plant very much as a rule. It is said to be quite good fodder, but gives a peculiar fishy flavour to milk and cream; hence the local name.
3. *Richardsonia brasiliensis*, a native of South America. It is sometimes called Mexican Clover, though it does not belong to the Clover Family, and is indeed botanically far removed from them. In other countries it has been highly spoken of as a fodder, but our experience in Queensland is that stock practically never touch it. It is rather a bad weed in some of the fruit farms on the North Coast Line.
4. *Rumex Brownii*, Native Dock.
5. *Apium leptophyllum*, commonly called Wild Carrot or Carrot Weed. It is eaten by stock, but gives a strong flavour to milk and cream.
6. *Chenopodium carinatum*, a strong-smelling weed for which we have not heard a common name.
7. *Anagallis arvensis*, the Scarlet Pimpernel, a common European weed now abundant in Queensland and the southern States. It is recorded as poisonous, but is mostly left untouched by stock. Some years ago, however, we received a number of seeds from the paunch of a cow that had been poisoned at Buderim Mountain, evidently through eating this plant. Dr. Gilruth has also recorded poisoning of sheep in Victoria through it.
8. *Stellaria media*, Chick Weed.

Galvanised Burr.

A.E.G. (Brisbane)—

Galvanised Burr (*Bassia Birchii*) is a native of Western Queensland and Western New South Wales. It is not an introduction, but has spread of recent years to an alarming extent especially along stock routes and in heavily stocked country. This is due to the grasses and more palatable herbage being eaten out, leaving this burr to reproduce freely. It sets an enormous quantity of seed, starting to seed at a very early stage and continuing till the end of its life. A plant probably lasts for two years, perhaps a little more. The burrs are spiny, a burr is borne in practically every leaf axil, and each contains a single seed.

The only method of eradication that has been practised successfully so far as we know is the costly one of hoe chipping. We are rather doubtful as to whether arsenical and other sprays would have very much effect on the plant, and their use in ordinary pastoral country is always attended with some risk. The plants, we think, are very brittle; perhaps if you are acquainted with them you could think of some mechanical means of control.

Plants and Shrubs Suitable for the Hughenden District.

H.C. (Brisbane)—

Following is a list of shrubs and other garden plants suitable for the Hughenden district:—

Most of the summer annuals, provided water is available, should do very well there, particularly hardy plants such as zinnias; in fact, the only ones that would probably be difficult to grow are asters, and unless unlimited attention can be given to these, their cultivation, we think, would be hardly worth worrying about. Of perennial flowers, probably the best to grow would be gerberas. The perennial calliopsis or coreopsis would be excellent, and would probably grow almost like a weed.

Of shrubs, the best type to grow is something subtropical. The various sorts of acalyphas should do quite well, although, unless in protected situations, they might be a bit tender during the winter months. Here is a list:—

Abutilon; any varieties.

Franciscea; flowers blue, turning white.

Crotalaria (Bird Flower).

Hibiscus. There is a multiplicity of varieties of these, and they are probably about the best things to grow as shrubs in the Hughenden district.

Jasminum. Several Jasminums would do. Probably the best would be *Jasminum grandiflorum*.

Lagerstrœmia; any of these would do.

Lasiandra; worth trying.

Murraya.

Oleanders. A great range of these in bright colours can be obtained. They are among the best of the flowering shrubs for the Hughenden district.

Ochna; yellow flowers followed by black fruits seated on a bright red receptacle.

Frangipanni; both the red and white varieties would do well there.

Rhaphiolepis; Indian Hawthorn.

As regards climbers, the best plants would probably be the Bougainvilleas. If your friend has time in passing through it would pay him to visit the Botanic Gardens at Townsville, and have a talk with the Curator of the Gardens, Mr. Johnson, who might be able to supply him with some of the plants.

Milk Thistle.

H.A.J. (Ayr, N.Q.)—

The specimen represents the Sow Thistle or Milk Thistle (*Sonchus oleraceus*), a species of thistle widely distributed over the warm temperate and tropical regions of the world. In Java the thistle is commonly used as a herb, the leaves being steamed and eaten with rice. In Queensland the milk thistle is much prized as green feed for caged birds. It is also said to have valuable tonic properties for horses, and is commonly much sought after by trainers on this account.

The Date Palm.

INQUIRER (Brisbane)—

Date Palms can be propagated either from seeds or suckers. Seedling plants come up quite freely in Queensland, often accidentally, and in some cases produce quite good dates. The male and female flowers in the date, however, are borne on distinct plants, and if you want to be certain of the sex, propagation must be from suckers. Unfortunately, the suckers do not root too readily, and even with a good deal of care there is always a certain number of losses; in fact, some authorities state that it is impossible to grow dates from suckers without a 50 per cent. loss. One could render the planting more satisfactory by banking up the earth around the sucker and inducing it to form roots while still on the parent plant. To ensure the best dates, the female flowers must be hand-fertilized, or at least partly hand-fertilized. This is usually done by opening the nearly ready male spathe, taking out a few male flowers, hanging them among the females, allowing them to open and the wind to scatter the pollen.

Shelter Trees.

J.L. (Goomeri)—

Some of the pines are good trees to plant as shelter for the cattle. Some of the true pines such as the Insignus Pine (*Pinus radiata*) or Long-leaved Pine (*Pinus longifolia*) should suit your purpose. Both these species are stocked by leading nurserymen. A pine that the Forestry Department is planting extensively at the present time, and which they say is giving good results, is *Pinus tæda*, the Loblolly Pine. Another tree that would do well is the Torulosa Pine (*Cupressus torulosa*). These may be purchased from nurserymen, either as seedling plants or plants raised from cuttings. The latter are more expensive, and for your purpose the seedling trees would suffice. This pine varies a little in shape, and if trees of a uniform character are desired it is better to get them raised from cuttings. The plants could be put in at the present time, although it is rather late. Get in touch with the Secretary, Sub-department of Forestry, Department of Public Lands, Brisbane, who might be in a position to supply you at a reasonable rate with Tæda or Loblolly Pines from their nearest nursery.

Button Burr.

A.C.W. (Capella, C.Q.)—

The specimen is the Button Burr (*Sida platycalyx*), a native of the Northern Territory, Central Australia, and parts of Western Queensland. We have from time to time received samples of this disc-like burr taken from wool received from Western Queensland. So far as we know, the burr is not growing naturally in your district, but if it were introduced it might become a bad weed. Fortunately, however, so far it has not shown any great tendency to spread, because, though it must be present in the wool of sheep from the far West, it does not seem to have spread east of the far western parts of the Warrego and Maranoa districts.

Ellangowan Poison Bush.

C. (Wandoan, Q.)—

The specimen has been identified as *Myoporum deserti*, the Ellangowan Poison Bush, a very common shrub in parts of Queensland. It was suspected for many years as a plant poisonous to stock, and recent feeding tests carried out at the Glenfield Veterinary Research Station, New South Wales, proved definitely the poisonous nature of the plant. Acute constipation and inflammation of the digestive tract are features of Myoporum poisoning. Most of the cases of trouble from this plant that come under our notice occur in travelling stock.

Shepherd's Purse.

C.McG. (Brisbane)—

The specimen forwarded represents *Capsella Bursa-pastoris*, the Shepherd's Purse, a common European weed now naturalised in most temperate countries. It is a very common weed in Southern Queensland. It is not known to be poisonous or harmful in any way, but like most members of the family *Cruciferæ* would taint milk very badly if eaten by dairy cattle to any extent.

General Notes.

Staff Changes and Appointments.

Constables W. Borghardt (Tewantin) and J. Kann (Kilkivan) have been appointed also Inspectors under the Slaughtering Act.

Messrs. W. Miller and W. Irwin, gatekeepers at the Buchan's Point Toll Gate and Third Beach Toll Gate, Cairns-Port Douglas road, have been appointed Honorary Rangers under the Native Plants Protection Act.

Miss M. A. Lyle has been appointed Assistant Cane Tester at the Kalamia sugar Mill as from 30th October, vice Mr. H. McAntee, resigned.

The Officer in Charge of Police, Malanda, has been appointed also an Acting Stock Inspector at that place.

Messrs. F. C. Coleman (Dairy Inspector, Pittsworth) and W. Dixon and H. J. D. McBean (Stock Inspectors at Goondiwindi and Millmerran) have been appointed also Inspectors under the Diseases in Plants Acts.

Sergeant W. Peters, Thursday Island, has been appointed also an Inspector under the Slaughtering Act.

Mr. J. A. Murray, Police Magistrate, Maryborough, has been appointed Chairman of the Mount Bauple and Maryborough Local Sugar Cane Prices Board, vice Mr. J. M. Bracewell, Police Magistrate, Gympie.

Acting Sergeant A. B. Brown (Biggenden) and Police Constables P. Byrne (Adavale), W. J. Crohan (Coomera), J. E. Wilson (Port Douglas), F. R. Nolan (Miriam Vale) have been appointed also Inspectors under the Slaughtering Act.

The Officer in Charge of Police at Cooyar has been appointed also an Acting Inspector of Stock at that place.

Messrs. H. Valentine (Bourbon Estate, South Bundaberg), W. G. Smith (Millbank, West Bundaberg), and A. Howe (Perry street, North Bundaberg) have been appointed Honorary Rangers under the Animals and Birds Acts.

Mr. A. P. Donnelly has been appointed Canegrowers' Representative on the Farleigh Local Sugar Cane Prices Board, vice Mr. H. G. Mulherin, resigned.

Messrs. A. R. Betts (Boonah) and R. J. O'Sullivan (Albion, Brisbane) successful candidates at the recent examination for Stock, Slaughtering, and Dairy Inspectors, have been appointed Inspectors under the Diseases in Stocks Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Acting Sergeant W. R. Hennessy (Goombungee) has also been appointed an Inspector under the Slaughtering Act.

Messrs. Ross Nott (North Adelaide) and A. L. Clay (Bondi, N.S.W.) have been appointed Government Veterinary Surgeons, Department of Agriculture and Stock.

The Price of Bananas.

Queensland banana-growers are acutely conscious of the low prices prevailing for their fruit on the local and Southern markets, remarked the Minister for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.) recently. He had asked for a report on the matter, and it appeared that the large area which had been planted up in New South Wales and now in bearing, was chiefly responsible for such a big increase in production. It did not appear likely there would be any improvement in prices in the immediate future, for we were about to enter our season of heaviest production. A study of the daily market reports in recent weeks showed that while reasonable prices were being returned for the higher grades prices for the minimum grade were very poor. One solution of the difficulty was for growers to concentrate on the production of higher grades. The Director of Fruit Culture (Mr. H. Barnes) had advised that if growers adopted a more intense system of pruning of bunches by removing the bottom two or three hands soon after the bunches were thrown, the size of the remainder of the fruit on the bunches would be correspondingly increased.

At present growers discarded the bottom first, and sometimes the second hands of most bunches at the packing-shed, because the fruit on such hands did not come up to the minimum size permitted to be marketed. It was sound cultural practice to prune any fruit tree with the object of getting better fruit, and at the present time particularly there was every reason why this rule should be applied also to bananas and the useless bottom hands cut away from the bunches at an early stage of growth, and the plant food which would ordinarily be used in the development of small fruit which would later be discarded directed into the upper hands of the bunches to produce larger fruit there.

In Memoriam.

CHARLES ROSS, F.R.H.S.

Mr. Charles Ross, one of the best known identities in the agricultural and horticultural life of the State, died on 2nd November. Mr. Ross, who was seventy-nine years of age, first learned the principles of horticulture in Yorkshire, England. He made further studies in temperate fruit culture in the open, and in tropical subjects under glass at leading establishments in the British Isles. When he landed in Brisbane, in 1878, he was engaged by the late Mr. Walter Hill, curator of the Botanic Gardens, as plant propagator. He later proceeded to the Darling Downs, where he designed, planted, and conducted extensive improvements in the orchards and pleasure grounds at Canning Downs and Strath Elbess, and was in charge of the first wheat experiments by the late Professor Shelton, at the former place. When the Government acquired the Hermitage State Farm, he was appointed the first manager in 1897, and during the first four years over 400 varieties of cereals were under observation. He was probably the first to discover canary grass (*Phalaris bulbosa*) growing on the Darling Downs. This grass is now recognised as among our best pasture plants, and extensive swards of it have been established, especially in the Southern States, where it has won a high reputation among stock owners. In 1901 he became manager of the Westbrook State Farm, where special features were made of fruit and vegetable culture. Mr. Ross commenced his last appointment in the Government service as Instructor in Fruit Culture in 1910, from which position he retired in 1921, having reached the age limit. In his capacity as Instructor in Fruit Culture his duties brought him into close contact with people throughout the State, and as his visits to the country frequently synchronised with the holding of local shows, at which his services as judge were eagerly sought, he became one of the best known experts of the Agricultural Department. For many years he also officiated as judge in the fruit and vegetable sections of the Royal National Exhibitions, Brisbane. In his younger days Mr. Ross was a familiar figure in the cricket fields of the Darling Downs. He was a member of the old Zingari Club in Warwick in the eighties and early nineties, and was then regarded as one of the finest wicketkeepers in the State. His passing is deeply regretted.

Vegetables for Export—New Bags must be Used.

Advice has been received from the authorities in New South Wales that vegetables exported from other States to New South Wales markets must be packed in new containers. The previous practice has largely been to use second-hand bags for vegetables such as pumpkins, carrots, parsnips, &c., but the use of such containers is now prohibited.

Another Tully Sanctuary.

Bellenden, the property of Messrs. Henry Brothers, near Tully, has been declared a sanctuary for the protection of native animals and birds.

Broom Millet Board.

An Order in Council has been approved under the Primary Producers' Organistation and Marketing Acts formerly extending the operations of the Broom Millet Board from 1st November, 1934, to 31st October, 1937.

An Order in Council giving notice of intention to extend the operations of the Board for a further term of three years was issued on 23rd August last, and a petition invited from growers on the question of continuance. No such petition was received.

Canegrowers' Roll.

For the purpose of Local and Central Sugar Cane Prices Boards elections, the electors' roll of canegrowers is compiled from lists of canegrowers furnished to the Central Board by millowners each season. It is now proposed to use an up-to-date list of assigned lands prepared by the Central Board in lieu of the roll as furnished by the millowners, and accordingly the Regulations under "*The Regulation of Sugar Cane Prices Acts*, 1915 *to* 1933," have been amended to make provision for the new form of canegrowers' roll.

Egg Board Election.

The following nominations for the annual election of five growers' representatives to the Egg Board for the year 1935 have been received:—

District No. 1 (Caboolture-Bundaberg)—
Ronald Benjamin Corbett (Woombye). Returned unopposed.

District No. 2 (Brisbane North-Redcliffe)—
Matthew Hale Campbell (Albany Creek).
Robert Auburn Chapman (The Gap, via Ashgrove).
Raymond Harrison (The Gap, via Ashgrove).

District No. 3 (Brisbane South-Cleveland)—
Christian Gisler (Wynnum).
Tom Hallick (Wynnum).

District No. 4 (Moreton)—
Johannes De Vries (Rosewood).
Heinrich Jacob Jurgensen (Moogerah).
Alexander McLauchlan (Boonah).

District No. 5 (Darling Downs)—
Walter Thos. Hughes (Middle Ridge, Toowoomba). Returned unopposed.

The present members are Messrs. Corbett, Hallick, McLauchlan, and Hughes. The position for District No. 2 was rendered vacant by the recent death of Mr. A. A. Cousner.

The date fixed for the return of the ballot-papers to the department is on or before the 29th December next.

Control of Grasshopper Plague.

The Executive Council has approved of a Proclamation and a Regulation under the Diseases in Plants Acts dealing with the control of the plague grasshopper. These prescribe the manner in which the pest shall be dealt with by the application of insecticidal mixtures, and provide for the appointment of supervisory committees in the shires to which the Proclamation and Regulation at present apply—namely, Waggamba, Inglewood, Pittsworth, and Millmerran. The occupier, or if there is no occupier, then the owner, of land in these shires is obliged to apply an insecticidal mixture in a prescribed manner on land infested with larval plague grasshoppers. A breach of the Regulation renders the person committing the breach liable to a penalty not exceeding £20, a similar penalty being prescribed for a false statement made in an application for the supply by the Department of Agriculture and Stock of the requisite insecticidal materials.

The Minister for Agriculture and Stock, Hon. F. W. Bulcock, pointed out that during the incidence of the first generation of grasshoppers much valuable control work was done by farmers and pastoralists. It was essential, however, that the grasshopper plague be fought on every holding on which it appeared; hence it had been considered desirable to acquire powers to deal with any member of the community who might not yet be alive to his responsibilities in this important matter.

The State Government was making very considerable quantities of the necessary insecticidal materials available free of charge, and stocks had been or were being established at Goondiwindi, Yelarbon, Whetstone, Inglewood, Texas, Pittsworth, Millmerran, Kooroongarra, Rocky Creek, and Mount Emlyn. Persons requiring to control the grasshoppers on infested properties could make application for insecticidal materials on the prescribed form, the application to be lodged with the officer, committee, or individual controlling the local stock of materials.

The Minister stated that the second generation of hoppers would commence emerging during the next week or two, and all farmers and pastoralists were urged to keep a very careful watch for such emergencies. Furthermore, they should realise that it was essential to apply the control measures during the early stages of the larval grasshopper's life while the pest was still concentrated in large numbers on or near the sites on which the hoppers had emerged from the eggs.

Covered Smut of Barley—A Correction.

It has been brought under notice that in the article on covered smut in barley in the Journal for March, 1934, the omission of the figure "0" from the fourth line of the first column of the table on page 239 makes it appear that Abavit B, 2 oz. per bus., was not tried in 1932. Actually it was included in the experiment, with very good results, the resultant infection being nil.

Rural Topics.

Fat Lamb Raising.

The scheme inaugurated by the Minister for Agriculture and Stock (Hon. F. W. Bulcock) last January is already giving results.

The first batch of lambs to come forward for open competition at the Abattoir were the property of Mr. R. Taylor, of Felton East. These lambs were sold on Thursday, 1st November, and it is gratifying to be able to state that the Southdown Cross lambs by the Department's loan rams topped the market. Lambs out of identical ewes by Dorset Horn rams and dropped under similar conditions came a very meritorious second. Experienced judges are of the opinion that the Dorset Cross lambs in this consignment were the heavier. This goes to prove the fashion at the present time existing for the Southdown Cross.

Officers of the Sheep and Wool Branch of this Department have lately inspected the greater number of farmers' flocks coming under the scheme, and from now on a steady stream of prime export lambs may be looked for up until January next.

Everywhere visited the lambs give promise of early development, and the figures compiled after the end of the selling season should prove valuable to the Department and highly instructive to the farmers.

The scheme has created a wide interest amongst farmers and, in addition to those farmers who already have rams, there is a waiting list of others desirous of getting rams should the scheme be extended.

It is not possible at this date to indicate the most successful crosses. Figures and conditions under which lambs were grown will have to be carefully studied subsequent to the end of the experiment.

It may, however, be stated that the experiment has proved highly successful, and in many cases farmers have already expressed their preference for certain of the British breeds.

Potato-growing as Part of a Mixed Farming Proposition.

Under the present economic conditions it was necessary that the unit cost of production be as low as possible, and the motto of potato growers should therefore, be, "not more acres, but more yield per acre," observed a special instructor in vegetable production of the New South Wales, Department of Agriculture, in the course of a recent address. It would perhaps be wise if potato-growing was considered more in the light of a mixed farming undertaking, particularly in conjunction with stock-raising, than as a one-crop farming venture.

The growing of fodder and grazing crops would be found of great advantage in improving the quality of the land for future potato crops. The maintaining of a satisfactory organic content in the soil was a matter of vital importance on potato areas, since the decomposed organic matter in the soil imparted a desirable texture. On many areas the lack of organic matter was very apparent, and such soils quickly compacted; should this happen shortly after planting of the potatoes low yields were certain. From recent United States experiments it would appear that the growing and turning under of maize crops the season previous to the potato crop was receiving increased attention. Maize had become popular owing to the large bulk of organic matter supplied to the soil. Full benefits from artificial fertilizers could only be expected in a soil which had a relatively high moisture-holding capacity, such as was imparted to the soil by the incorporation of organic matter, in conjunction with proper cultivation methods.

Imported Berkshires.

It is of interest in reviewing the progress of the Berkshire breed to note that recent importations of selected stock in this breed have quite remarkable overseas records. The Berkshire sows imported last year by Mr. Frank Bach, of Oakey, are typical. The champion Berkshire boar at the English Royal Show in 1934 is from the same stud as that from which Mr. Bach selected his champion sow, "Lenton Patience," and also the reserve champion at the English Royal is from the herd where his younger sow came from.

It is understood with a view to further strengthening his herd, Mr. Bach is now importing another animal, a specially selected Berkshire boar from one of the most noted studs in England. Such importations are of great value to the Berkshire breed in this country.

An Australian Harvester-Thresher.

Following is an interesting extract from the "London Morning Post," 23rd August, 1934:—A new harvester thresher has been introduced into England by Mr. Scott, of Knighton Manor, near Salisbury. It is called the Sunshine harvester, and is of Australian origin. It pushes its way into the crop by its own power. It does not require a tractor to pull it, and so avoids the necessity of mowing round the field, or running over the grain from the outside.

The Average Cow—"Better Fed than Bred."

Discussing the feeding of dairy cattle before the recent Illawarra and South Coast Agricultural Bureau Conference, Mr. H. Cox, of Kangaroo Valley, said that the average dairy cow was much better bred than fed, or, in other words, was not fed well enough to enable her to yield her potential production.

The ration should not only be sufficient and correctly balanced, but should also have variety, succulence, and palatability. A nutritive ratio of 1:6.3 (1 part of protein to 6.3 parts of carbohydrates and fats) was considered ideal. In these days of low prices of dairy products it was necessary to consider carefully all the costs of production. If the dairy farmer could grow lucerne and maize his farm should be self-supporting as far as fodder was concerned. If it was necessary to buy concentrates, then extra fodder should be grown for sale to compensate for the expense.

By the improvement of pastures a ration nearly balanced could be provided and one which would keep the cows in good health.

Mr. Cox suggested the following daily rations:—

Maize silage, 30 lb.; lucerne chaff, 16 lb.; maize meal, 5 lb.; nutritive ratio, 1:6.3.

Maize silage, 35 lb.; lucerne chaff, 8 lb.; maize meal, 5 lb.; bran, 6 lb.; nutritive ratio, 1:5.6.

Maize silage, 30 lb.; maize meal, 5 lb.; bran, 7 lb.; wheaten chaff, 10 lb.; nutritive ratio, 1:6.9.

Lucerne chaff, 15 lb.; wheaten chaff, 5 lb.; bran 6 lb.; maize meal, 2 lb.; nutritive ratio, 1:5.9.

How to Maintain Quality in Cream.

Absolute cleanliness is the first law in profitable dairying, and a substantial proportion of the remedies for common cream faults come under this heading. Following are some hints on other aspects of prevention:—

Cool all cream promptly after separating.

Do not expose cream or cans to the direct rays of the sun.

Deliver to the factory frequently—not less than four times weekly. Deliver daily in summer time.

If possible, send all the cream in the dairy on days of delivery; any left over should be kept as cool as possible.

Do not mix fresh cream with older cream until the former has been cooled. Give the whole an occasional stir to make the mass uniform, and stir at least four times daily.

Prevent cows from wading in stagnant water; udders of cows should be washed and wiped before milking.

At least once a day remove all cow droppings 100 feet from dairy, yards, and bails.

Never use milk from sick cows, or from cows too soon after calving.

Use clean, sound brushware only in cleaning utensils—never use cloths.

Use only smooth, well-tinned tinware and cans, with all seams soldered flush.

If possible keep cows away from rank or objectionably flavoured weeds. Feed cows at least two hours prior to milking—better still, feed just after milking.

Do not send a very small quantity of cream to the factory in a can of large capacity if any distance is to be travelled.

Have the engine outside the separating room, and extend the engine exhaust to blow clear of the building. Keep smoke away from the dairy, and all strong-smelling material out of the dairy. On no account use water that has been heated in the engine jacket for washing.

Do not use strong-smelling disinfectants in water for washing.

Young or Old Boars?—How Long may Service be Extended.

Replies from prominent pig breeders to a questionnaire by the "Pig Breeders' Gazette" were made as follows:—

"Does an old boar produce as large and as strong litters as a young boar? If not, at about what age does he cease to do so?"

The general opinion seems to be that a boar is never too old so long as he is prolific and can produce constitutionally strong litters. The following were some of the replies received:—

"Really, it depends on constitution; some boars never seem tired. I castrated one nine years of age, four years ago, and am still regretting it and wishing him back. Others pack up at three years, or even earlier.

"As long as conception results from the service, my opinion is that the number and strength of the litter depend almost entirely on the dam."

"Much depends on the individual sire and his management. Some sires seem to go on for years—up to seven and eight—and to get vigorous, healthy litters, while others fail when three to four years old.

"A boar becoming bad-tempered may shorten his useful life, but a boar too young and too hard at the start of his work has the greatest limiting effect, while running him on free range with a bunch of sows is extremely wasteful.

"Between the litters of young, vigorous boars and old, vigorous boars there seems comparatively little to choose, the variations usually being attributable to factors other than age. It has been found that the use of a suitable service crate will often improve the size and strength of litters from an old boar."

"I do not think that it is either a question of age or the strength and size of his get that determines the usefulness of a boar; one thing that I am certain of, however, is the fact that it is impossible to lay down a hard and fast rule as to a limit of age at which he ceases to get good litters, also that anyone who makes a definite statement in regard to it is either lacking in experience or observation.

"One of the greatest factors in keeping a boar fit is to give him plenty of work, after he is mature; by plenty, I do not imply that it is wise to let him run with sows. His services should be controlled, and, if he is big and heavy, a crate should be used for him; and provided he is well fed with a suitable ration, containing a fair amount of protein, there is no reason why his litters should diminish in size or strength, even though he may be eight or nine years of age, whereas there are many boars, whether from mismanagement or from some constitutional weakness, which seem to lose their usefulness at half this age, or even less.

"I am confident that periods of rest from service are not conducive to the length of useful life of a boar, neither are they with regard to the size and strength of litters. It is owing to this fact, I am inclined to think, that we breeders so often get rid of our second string stock boar before he has had a real chance to prove his worth."

A Travesty of North Queensland.

The writer of a recent work of fiction has chosen the surroundings of a North Queensland sugar mill as the venue of his story of the life of an Australian born of Italian parents. With the quality of the book as a whole we are not here concerned; but what needs emphatically to be stated is that as a picture of life in any part of Queensland, north or south, it is distinctly and dangerously misleading. One of its Melbourne reviewers has hailed it as "an accurate picture of a typical small town in the Queensland sugar belt," and "as showing us a glimpse of a hitherto unfamiliar country"—so unfamiliar is it that such a place is unknown to Queenslanders themselves, nor is it discoverable outside the pages of what in more senses than one is, as we have said, "a work of fiction." It has never been denied that North Queensland, in certain parts, has become the home of numbers of Continental Europeans, amongst whom, as amongst every race, there are a proportion of undesirables; but the unrelieved squalor and undiluted foreignisation described by the writer are certainly non-existent, whilst the miseries of the wet season are grossly exaggerated. The low death-rate of the population and the bright vigour of the children attending the schools, so consistently remarked upon by visitors from the South, are evidence of a very different state of things. "Eulaville," the name adopted by the author for his visionary sugar town, is represented as occupied almost solely by a polyglot crowd, amongst whom the strong self-respecting

Well and Sub-Artesian Bore Sites

The services of the Government Water Finder (Mr. J. H. Bestmann) are available to settlers in Queensland for the purpose of locating well or sub-artesian bore sites.

A fee of 10s. is charged for each site selected, together with a mileage rate of 1s. a mile (one way) from the nearest railway station to the site.

Applications should be addressed to the Secretary, Land Administration Board (Public Estate Improvement Section), Department of Public Lands, Brisbane.

Note.—The Water Finder will be sent to distant localities only if there are a sufficient number of applications from such localities to warrant the necessary expenditure.

Tobacco Seed for Sale

Seed of the following varieties of tobacco seed is procurable from the Department of Agriculture and Stock, Brisbane, at the rate of 4s. per oz., postage paid, cash with order:—

Hickory Pryor, Yellow Pryor, Cash, Warne, and Gold Leaf.

Applications for seed should be addressed to the Under Secretary, Department of Agriculture and Stock, Brisbane.

All seed has been secured from plants grown in disease and mould free areas, and, after grading, treated with silver nitrate solution.

No necessity exists for further treatment of the seed.

Australian is absent. The legislation by which the sugar industry in Queensland is studiously regulated and organised is unknown in that fabled region. The mill itself, so far as it enters into the story, is different from all others—as, for example, the existence of open pans of boiling sugar, a trap for unwary feet, is unknown in modern practice, and an operating factory, remaining in the dead of night with a venal watchman as the sole occupant, is an absurdity. The writer apparently is unacquainted with the fact that the labour in the sugar mills is almost exclusively of ''British'' nationality. But perhaps the most misleading incident of all is that in which the whole of the ''foreigners'' band together to defeat a waterside strike, in which they are in no way interested, by forcefully and illegally attempting to load the steamers, in spite of police and shipping officials. This is really a travesty of what occurred some years ago in a port very much further south, when the farmers, almost exclusively Australians, went down to the wharf in orderly and lawful combination and thus secured the shipment of the raw sugar which the striking waterside workers had refused to handle. The foreign-born elements in this country have never been responsible for any approach to such conduct as that described by the writer of this book, nor are they ever at all likely to be. The brief quotation from a review which we give above is an example of the mischief likely to be wrought in unreflecting and prejudiced minds, already predisposed to think evil of a remote part of their own country.

In connection with the above, an interesting article appears in the ''Launceston Examiner'' of 23rd August. In the light of what is stated in the book, and of the recent articles by a special investigator commissioned by the Brisbane ''Telegraph'' to inquire into the state of affairs in the North Queensland sugar district, the Tasmanian journal gives a very judicial summing up of the position, as follows:—''The weight of evidence would seem to suggest that the Italian is by way of becoming a useful member of the community of the North, and of becoming ultimately a good, if somewhat emotional, Australian.''—''The Australian Sugar Journal'' for September.

Good Feeding Means Profitable Dairying.

Great improvement had been made in the class of stock bred in the Manning River district during the past twenty years, said Mr. J. A. Grant, manager of Wingham Butter Factory, N.S.W., addressing a recent gathering of local dairy farmers, but many farmers had failed to realise how much depended on the proper feeding of their stock. He predicted, however, that more attention would be given this aspect of dairying in the near future, as farmers were beginning to realise how uneconomical it was to keep even a champion milker if she were only half fed. Under these conditions such a large proportion of the feed went to keep the cow warm and to supply energy, that little was left for the production of milk.

Quoting as an example the operations of one particularly successful farmer he had observed for very many years, Mr. Grant stated that this man only reared sufficient calves to replace any cows that had passed their best, and the calf was only retained after careful examination of the breeding and production records of dam and sire, and after a check-up on its size, conformation, and health. The culled cows were spayed, and in a few months were fat enough to sell to the butcher. This was only possible because there was always an abundance of feed for the cattle. He was best able to judge as to the efficiency of this farmer's methods by the surprisingly regular amount of his monthly cheque.

This farm was not on rich country, but was rather steep and hilly. As a consequence of rearing so few calves, a comparatively large number of pigs were reared and fattened. The young pigs and breeding stock were grazed on rape in the winter and lucerne in the summer, with a very small quantity of milk and an abundance of water. When the young pigs were grown sufficiently they were fattened as rapidly as possible on maize and milk, which constituted an excellent ration. It had frequently happened that during a more or less dry year this farmer had made more money from his pigs alone than his neighbour, with a better farm, had made from his cows and pigs combined.

The explanation was to be found in better feeding as a result of better general management of the farm.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

Summer Diarrhœa.

It is not many years since diarrhœa was the most frequent cause of death among babies. Diarrhœa was then most prevalent during the hot summer months, partly because milk rapidly becomes unwholesome when exposed to summer heat, but chiefly owing to the infection of milk from the growth of disease germs, which are always more or less prevalent during that season. Of recent years there has been an amazing lessening of the number of deaths caused by diarrhœal infections among babies. But some deaths from this cause still occur annually, and only by an intelligent use of our knowledge of their causes can these dangerous diseases be prevented.

Diarrhœa is the passage of frequent loose or watery motions. It is caused by the presence of some irritating material in the bowels. The bowels are trying to expel this, and so the motions are frequent. The contents of the bowel are being hurried through, and so they are watery. According to their cause, we may divide diarrhœas into food diarrhœas and infectious diarrhœas.

Food Diarrhœas.

These may be caused by simple overfeeding with food that is quite suitable, when not given in excess. This may occur at any time of year, but is more likely in summer, because babies are then often thirsty. Mothers sometimes fail to distinguish between hunger and thirst in babies, and yet it is easy. Thirst is satisfied by plain boiled water, and the baby should be given as much of this as he wants between feeds. Milk is a food, and thirst may induce an infant to take too much of it when he is not hungry, and so he gets upset.

Unsuitable foods may cause diarrhœa. There are so many kinds of unsuitable foods given to children and babies, that we shall not attempt any list of them. We may divide them into those which the mother gives, because she knows no better, and those which the babe, who has reached the crawling stage, finds for himself on the floor or elsewhere.

In hot weather milk rapidly becomes unwholesome from the growth of putrefactive organisms, unless the milk is kept cold. Especially is this likely to happen quickly if the milk has been obtained or handled in a dirty manner. If we remember these three causes of food diarrhœa in babies, their prevention is simple.

Treatment of Food Diarrhœas.

This also is simple. It is usually wise to give a teaspoonful of castor oil at the beginning to clear out the irritating material. At the same time we completely cease giving the babe any milk. He may drink as much very weak barley water, which may be slightly sweetened, as he likes. After twenty-four hours he should be distinctly better, but should

be kept on the barley water for another day if necessary until the motions begin to improve. He may then be given whey made with junket tablets. The whey is allowed to drip through cheese-cloth without any squeezing. Give nothing else to the babe under nine months. The babe over nine months may, if he is hungry, have some water-sago, or water-arrowroot, perhaps flavoured with a trace of marmite, or if he has teeth, a small piece of baked bread. No cow's milk must be given until the motions are much improved, and then only a small spoonful or two with each feed. If this is well digested, the quantity must be gradually increased. If the baby is breast-fed it is not necessary to diet him so strictly, and small feeds of breast milk may be given once or twice daily as the baby improves, instead of giving whey.

Infectious Diarrhœas.

These are much more serious. The infant may be very ill at the beginning, and medical advice should be sought at once. Sometimes the disease is deceitfully mild at first, but does not improve with simple treatment. Therefore, if the treatment for food diarrhœa is not followed by improvement within twenty-four hours, to seek medical advice is the only safe course. Especially is this necessary when the passage of blood and slime with straining shows that it is a case of dysentery.

The Prevention of Infectious Diarrhœas.

The responsibility for this rests with the mother. Breast-fed babies are much safer than those on the bottle. Therefore, we do not wean babies during the hottest months, if we can help it. The infection may be conveyed to the baby's food by dirty fingers, but more commonly is conveyed by flies. All milk should be scalded, unless pasteurised and in sealed vessels. It must be kept cool and most carefully protected from flies. The bottles and teats used by artifically-fed infants must be boiled, and afterwards most carefully shielded from flies. Flies are fond of alighting on the baby's dummy—we regret to say that these horrible things are still used by some mothers. The best safeguard for these babies is to burn the dummy.

ILL-NOURISHED CHILDREN.

THE skilled observer may see poorly-nourished children wherever he goes. Fortunately, they are usually fewer in number than the well-nourished children, but there are many of them. Their number varies in different places and at different times, but they are always present. There are many causes of poor nutrition, but in all but a few the cause is simply defective diets. By this we do not mean that the children do not get enough food. They probably get as much as they will eat; they may even get expensive foods, but they do not get the right sort of food. Their mothers have never received a right education and are not to be blamed for want of knowledge which no one has taught them. They are not to be blamed, but their children suffer all the same.

There is a widespread belief that the important foods are meat, white bread, butter, and sugar, and that all other foods are extras. Of the five necessary vitamins, meat contains only one, while bread and sugar contain none, and butter, which is valuable for its vitamins,

is expensive and is being replaced by margarine. So long as times are good most people take a large variety of foods, and these often supply all that is needed in the diet; but when times are bad and thousands are on relief wages, it is only natural that mothers should concentrate on what they think the important foods. They satisfy their children's appetites with foods on which really good health is impossible. There is no starvation, but much bad feeding. Poverty is not the cause. The cause is want of knowledge, the evil effects of which are made more dangerous by want of money. The foods that are essential to children's health are only too often cut out because the mother thinks they are not important, and therefore she cannot afford to buy them. Meanwhile she spends money unnecessarily on foods of inferior value.

Milk the Most Important Food.

The most important of foods for children is milk, and this is often the first to be cut out. In some places poorly-nourished children have become very numerous. It is sad to see so many of the next generation being spoilt in the making—so many that will never grow strong men and women, but will help to fill our hospitals, when in later life they fall victims to all kinds of diseases—so many that will fall easy victims to tuberculosis, or become hopelessly crippled with chronic rheumatism. The condition of their teeth will be such that all the dentists in Queensland working overtime, Sundays and holidays included, will not be able to do what is necessary. Every child under six should have a pint of good milk in some form or another daily. Every child over six should have at least half a pint, but a whole pint would be better. As it is, many families are given only a little condensed milk, or some powdered skimmed milk, in large quantities of water—a mere pretence of proper nourishment.

What can we propose for this great evil? Firstly, we must dispel this want of knowledge. Out Infant Welfare Service is responsible for all children under school age, and is doing its best to help their mothers. This work is difficult and slow, and we cannot reach mothers not within easy distance of our centres. A large number of new branch clinics are much needed. The next generation of mothers will, we hope, have been better educated before they leave school. Secondly, there are ways in which we can directly encourage the increased consumption of milk. These will be explained in our next article.

SIMPLE COOKERY.

BAKED ORANGE PUDDING.

Materials—1 slice bread; 2 eggs; 1 pint milk; 1 dessertspoonful butter; 1 dessertspoonful sugar; 2 oranges.

Utensils—Pie dish; basin; saucepan; whisk.

Method—

1. Look to the oven and grease pie dish.
2. Place milk on to boil.
3. Put bread into pie dish and pour boiling milk over it.
4. Beat egg and sugar together.
5. Add grated orange rind and juice to egg.
6. Pour over the soaked bread.
7. Add a little butter.
8. Bake in moderate oven. Place dish in cold water.
9. Serve cold.

STEAMED GINGER PUDDING.

Materials—½ lb. flour; 3 oz. dripping; 3 oz. sugar; ½ cup milk; ½ cup treacle; 1 tablespoonful ginger; 1 dessertspoonful each of cinnamon and spice; 1 teaspoonful soda.

Utensils—Bowl; sieve; wooden spoon; basin; paper; steamer.

Method—

1. Cream dripping and sugar; add milk and treacle; mix well.
2. Add flour sifted with spice, ginger, salt, and soda.
3. Pour into a greased basin; cover with greased paper.
4. Steam for 3 hours; turn out; serve with sweet, white sauce.

STEAMED URNEY PUDDING.

Materials—¼ lb. flour; 3 oz. butter or dripping; 2 oz. sugar; 2 eggs; ½ teaspoonful carbonate soda; 1 tablespoonful seeded jam.

Utensils—Steamer; basin; greased paper; wooden spoon; whisk.

Method—

1. Put water on to boil.
2. Beat butter and sugar together.
3. Add egg well beaten with jam.
4. Sift in flour and baking soda.
5. Steam 1½ hours.
6. Serve with white sauce or jam.

TAPIOCA (BOILED).

Materials—2 tablespoonfuls tapioca; ½ pint milk; ½ pint water; 1 dessertspoonful sugar.

Utensils—Basin; saucepan.

Method—

1. Wash tapioca well; cover with water.
2. Soak it 1 hour.
3. Put it into a saucepan; add milk and sugar.
4. Cook till clear and tender; serve with milk or cream.

TAPIOCA CREAM.

Materials—¼ cup tapioca; 1 pint milk; 2 eggs; 2 tablespoonsful sugar; essence of vanilla.

Utensils—Basin; saucepan; wooden spoon; whisk.

Method—

1. Soak the tapioca in milk or water over night.
2. Place over the fire and boil till clear.
3. Beat yolks of eggs and sugar well together.
4. Add to the tapioca; allow to thicken, but do not boil; whisk whites to a stiff froth; add half to the mixture when cold; beat well.
5. Turn into glass dish; decorate with coloured cocoanut and remaining white of egg; serve with stewed fruit.

COCOANUT BISCUITS.

Materials for Biscuit.—¼ lb. butter; ¼ lb. sugar; essence or grated lemon rind; yolks 2 eggs; ½ lb. flour.

Materials for Top—Whites 2 eggs; ¼ lb. icing sugar; ¼ lb. cocoanut.

Utensils—Bowl; wooden spoon; sieve; cutter, baking tin.

Method—

1. Cream butter and sugar together; add essence and yolks of eggs; beat well.
2. Sift in flour; turn out on floured board and knead.
3. Roll out and cut into biscuits with a round cutter.
4. Spread cocoanut mixture on top and bake on a greased tin in a moderate oven half an hour.

Cocoanut Mixture—Whip whites of eggs until stiff; add cocoanut and icing sugar until a thick paste is formed.

GINGERBREAD.

Materials—¾ lb. flour; pinch of salt; ¼ lb. butter or dripping; ¼ lb. sugar; 2 teaspoonfuls ginger; 1 teaspoonful mixed spice; ½ cup treacle; ½ teaspoonful soda; 2 eggs; ¼ cup milk.

Utensils—Sieve; bowl; saucepan; basin; whisk; cup; wooden spoon; baking tin.

Method—

1. Sift flour, salt, ginger, and spice into a bowl.
2. Heat the butter or dripping, sugar, and treacle, stirring until the mixture is smooth.
3. Beat eggs well; slightly heat the milk; dissolve soda in it.
4. Mix all wet ingredients together.
5. Add to the dry ingredients; stir until smooth.
6. Pour into a greased tin; bake in a moderate oven for about 1¼ hours.

LEMON BUNS.

Materials—2 oz. butter; 2 oz. sugar; 1 egg; ½ cup milk; lemon essence or grated rind; ½ lb. flour; 1 teaspoonful cream of tartar; ½ teaspoonful soda.

Utensils—Bowl; wooden spoon; cup; grater; sieve; baking tin.

Method—

1. Beat butter and sugar to a cream; add essence or rind, and egg.
2. Beat well; add milk and flour sifted with cream of tartar and soda.
3. Take pieces of mixture and form into balls; brush over with egg and milk, and sprinkle with pink sugar.
4. Put on greased tin; bake till slightly browned.

NUT FINGER BISCUITS.

Materials—¼ lb. butter; 2 oz. sugar; ½ lb. flour; 1 small teaspoonful baking powder; 1 egg; ¼ lb. icing sugar; 1 oz. nuts.

Utensils—Bowl; rolling-pin; knife; pastry board; plate; wooden spoon.

Method—

1. Attend to the oven.
2. Beat butter and sugar to a cream.
3. Add yolk of egg and beat well.
4. Sift in flour and making powder.
5. Mix all well together until crumbly.
6. Add 1 or more tablespoonfuls of boiling water to blend mixture into a stiff dough.
7. Beat icing sugar and white of egg together.
8. Chop nuts up finely.
9. Roll out paste to less than ¼-inch thickness; cut into a square.
10. Spread over icing and sprinkle with nuts.
11. Cut into finger lengths 1 inch by 3 inches.
12. Bake on greased tray in moderate oven.

SHORTBREAD.

Materials—4 oz. butter; 2 oz. icing sugar; ½ lb. flour.

Utensils—Bowl; sieve; rolling-pin; baking dish.

Method—

1. Cream sugar and butter together till white.
2. Add sifted flour.
3. Turn out on floured board; knead; cut into halves; roll out; pinch edges; put on baking dish.
4. Bake in a slow oven for 1 hour.

Note.—The amount of flour may be reduced slightly.

SPONGE ROLL.

Materials—3 eggs; ½ cup sugar; 1 cup flour; 1 teaspoonful baking-powder; 2 tablespoonfuls jam; 1 tablespoonful water; icing sugar; dripping or butter for greasing tin.

Utensils—Bowl; whisk; sieve; jam-roll tin; cloth.

Method—

1. Break eggs into a bowl.
2. Add sugar; whisk till thick; add water.
3. Add flour mixed with baking-powder.
4. Bake in greased jam-roll tin.
5. When cooked turn out on clean cloth; roll up quickly; unroll; spread with jam; roll up; sprinkle with icing sugar.

BREADMAKING.

To make Yeast.

Materials—1 potato; 2 tablespoonfuls loose hops; 1 tablespoonful sugar; 1 tablespoonful flour; 3 cups of water.

Utensils—Saucepan; basin; cup; strainer; bottle.

Method—

1. Wash potato; slice it into a saucepan.
2. Cover with water; boil till soft.
3. Put hops into a basin; add 1 cup of boiling water.
4. Cover; let cool.
5. Mix sugar and flour together with water.
6. Add hops, potatoes, and remainder of water.
7. Strain; bottle; tie cork down securely.

To make Bread.

Materials—1 lb. flour; ¼ cup yeast; ½ pint tepid water; ½ teaspoonful salt.

Utensils—Bowl; tin; knife.

Method—

1. Sift flour into a bowl.
2. Mix yeast and half water together.
3. Make a well in centre of flour.
4. Pour in yeast and rest of water.
5. Mix into dough; cover with a cloth.
6. Let stand in a warm place for 6 hours; add salt.
7. Knead for 30 minutes; form into loaves; let stand to rise.
8. Bake in hot oven 40 minutes.

WHOLEMEAL BREAD.

Materials—1 lb. wholemeal; ¼ cup yeast; ½ cup lukewarm water; ¼ teaspoonful salt.

Utensils—Bowl; cup; knife; tins.

Method—

1. Put whole meal into a bowl.
2. Mix into a smooth, soft dough, with yeast and water.
3. Stand aside in a warm place for 3 hours; add salt.
4. Turn out on a board; knead; divide into pieces; form into loaves.
5. Place in greased tins; stand for an hour.
6. Bake in a moderate oven.

Compressed Yeast.

Compressed yeast, a putty-like mass of yeast plants, may be purchased; it will only keep for two or three days; if it is not possible to use it at once, it should be kept in a cool, dry place.

BREAD MADE WITH COMPRESSED YEAST.

Materials—1 lb. flour; ½ oz. compressed yeast; ½ teaspoonful salt; ½ teaspoonful sugar; about ½ cup of warm water.

Utensils—Sieve; basin; wooden spoon; board; knife; tin.

Method—

1. Sift flour into a warmed basin; crumble yeast into middle of flour.
2. Sprinkle sugar over yeast; add 2 tablespoonfuls of lukewarm water.
3. Stir until the centre of the flour is like batter; stand in a warm place for 10 to 12 minutes.
4. Sprinkle salt over dough; mix well, adding sufficient warm water to form dough.
5. Turn out on a floured board; knead well.
6. Return to warmed basin; cut across surface with a floured knife.
7. Cover and let stand in a warm place for 35 to 40 minutes.
8. Turn out on a floured board; knead it into shape; put into a greased tin, leaving about one-third of the space for rising; stand in a warm place for 10 minutes.
9. Put into a hot oven for 5 to 10 minutes; decrease heat; allow 30 to 40 minutes to complete the baking.

Note—The whole process takes from 1¾ to 2 hours.

BILLY BREAD.

Materials—1 cup flour; 1 cup wheatmeal; 2 teaspoonfuls baking powder; ½ teaspoonful salt; 1 dessertspoonful butter or dripping; 1 dessertspoonful sugar; ½ cup treacle; ½ cup milk; dripping to grease tins.

Utensils—Bowl; cup; fork; board; groats or other tins with lids or billy can; skewer.

Method—

1. Put wheatmeal and flour sifted with baking powder and salt into a bowl.
2. Add sugar; work butter or dripping in with the tips of the fingers.
3. Make a well in the dry ingredients; pour in the milk and treacle well mixed together.
4. Work into a damp dough with a fork; turn out on a slightly floured board; knead for 1 minute.
5. If necessary divide the dough; put into well-greased tins or billy can, leaving not less than one-third of the space for rising.
6. Put lids on; bake in a moderate oven for 1 to 1½ hour; the time will depend on the size of the tin or billy can; test with a skewer.

Note—Nuts, shelled and cut up, sultanas, dates, or other dried fruit may be used with this mixture to make nut loaf, date loaf, &c.

NUT BREAD.

Materials—2 cups self-raising flour; 1 cup brown sugar; 1 cup milk; 1 egg; ½ cup chopped nuts; 1 teaspoonful salt.

Utensils—Bowl; wooden spoon; baking tin with lid.

Method—

1. Grease tin and look to the oven.
2. Sift flour and salt into a bowl.
3. Add sugar and nuts.
4. Make well in centre; break in the egg and add milk.
5. Mix all together quickly.
6. Half fill coffee tin and bake with lid on for 1 hour in moderate oven.

Orchard Notes for January.

THE COASTAL DISTRICTS.

ALL orchards, plantations, and vineyards should be kept well cultivated and free from weed growth; in the first place, to conserve the moisture in the soil, so necessary for the proper development of all fruit trees and vines; and, secondly, to have any weed growth well in hand before the regular wet season commences. This advice is especially applicable to citrus orchards, which frequently suffer from lack of moisture at this period of the year if the weather is at all dry, and the young crop of fruit on the trees is injured to a greater or less extent in consequence.

Pineapple plantations must also be kept well worked and free from weeds, as when the harvesting of the main summer crop takes place later on, there is little time to devote to cultivation. If this important work has been neglected, not only does the actual crop of fruit on the plants suffer, but the plants themselves receive a setback.

Banana plantations should be kept well worked, and where the soil is likely to wash badly, or there is a deficiency of humus, a green crop for manuring may be planted. Should the normal wet season set in, it will then soon cover the ground without injury to the banana plants. When necessary, banana plantations should be manured now, using a complete manure rich in potash and nitrogen. Pineapples may also be manured, using a composition rich in potash and nitrogen, but containing no acid phosphate (superphosphate) and only a small percentage of bonemeal, ground phosphatic rock, or other material containing phosphoric acid in a slowly available form.

Bananas and pineapples may still be planted, though it is somewhat late for the former in the more southern parts of the State. Keep a good lookout for pests of all kinds, such as Maori on citrus trees, scale insects of all kinds, all leaf-eating insects, borers, and fungus pests generally, using the remedies recommended in Departmental publications.

Fruit fly should receive special attention, and on no account should infested fruit of any kind be allowed to lie about on the ground to become the means of breeding this serious pest. If this is neglected, when the main mango crop in the South and the early-ripening citrus fruits are ready, there will be an army of flies waiting to destroy them.

Be very careful in handling and marketing of all kinds of fruit, as it soon spoils in hot weather, even when given the most careful treatment. Further, as during January there is generally more or less of a glut of fresh fruit, only the best will meet with a ready sale at a satisfactory price.

Grapes are in full season, and in order that they may be sold to advantage they must be very carefully handled, graded, and packed, as their value depends very much on the condition in which they reach the market and open up for sale. Well-coloured fruit, with the bloom on and without a blemish, always sells well, whereas badly coloured, immature, or bruised fruit is hard to quit.

One of the greatest mistakes in marketing grapes is to send the fruit to market before it is properly ripe, and there is no better way to spoil its sale than to try and force it on the general public when it is sour and unfit to eat.

Bananas for sending to the Southern States require to be cut on the green side, but not when they are so immature as to be only partially filled. The fruit must be well filled but show no sign of ripening; it must be carefully graded and packed and the cases marked in accordance with the regulations under the Fruit Cases Acts and forwarded to its destination with as little delay as possible.

Pineapples should be packed when they are fully developed, which means that they contain sufficient sugar to enable the fruit to mature properly. Immature fruit must not be marketed, and if an attempt is made to do so the fruit is liable to seizure and the sender of the fruit to prosecution under the abovenamed regulations. Further, the fruit must be graded to size and the number of fruit contained in a case must be marked thereon. Immature fruit must not be sent. For canning, the fruit should be partly coloured; immature fruit is useless; and over-ripe fruit is just as bad. The former is deficient in colour and flavour and the latter is "winey" and of poor texture, so that it will not stand the necessary preparation and cooking.

Should there be a glut of bananas, growers are advised to try and convert any thoroughly ripe fruit into banana figs.

The fruit must be thoroughly ripe, so that it will peel easily, and it should be laid in a single layer on wooden trays and placed in the sun to dry. If the weather is settled, there is little trouble, but if there is any sign of rain the trays must be stacked till the weather is again fine, and the top of the stack protected from the rain. To facilitate drying, the fruit may be cut in half lengthways. It should be dried till a small portion rubbed between the finger and thumb shows no sign of moisture. It can be placed in a suitable box to sweat for a few days, after which it can be dipped in boiling water to destroy any moth or insect eggs that may have been laid on it during the process of drying and sweating. It is then placed in the sun to dry off any moisture, and when quite dry it should be at once packed into boxes lined with clean white paper. It must be firmly packed, when, if it has been properly dried, it will keep a considerable time. It can be used in many ways, and forms an excellent substitute for raisins, sultanas, currants, or other dried fruits used in making fruit cakes and other comestibles. Banana figs will be found useful for home consumption, and it is possible that a trade may be built up that will absorb a quantity of fruit that would otherwise go to waste.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JANUARY is a busy month in the Granite Belt, and orchardists are fully occupied gathering, packing, and marketing the crop of midseason fruits, consisting of plums of several kinds, peaches, nectarines, pears, and apples. The majority of these fruits are better keepers and carriers than those that ripen earlier in the season; at the same time, the period of usefulness of any particular fruit is very limited, and it must be marketed and disposed of with as little delay as possible.

With the great increase in production, owing to the large area of new orchards coming into bearing and the increasing yields of those orchards that have not come into full profit, there is not likely to be any market for immature or inferior fruit. There will be ample good fruit to fully supply the markets that are available and accessible. Much of the fruit will not carry far beyond the metropolitan market, but firm-fleshed plums, clingstone peaches, and good firm apples should stand the journey to the Central District, and, if they are very carefully selected, handled in a manner to prevent any bruising, and properly graded and packed, they should carry as far as Townsville. Growers must remember that, given a market fully supplied with fruit, only such fruit as reaches that market in first-class condition is likely to bring a price that will pay them; consequently the grower who takes the trouble to send nothing but perfect fruit, to grade it for size and colour, to pack it carefully and honestly, placing only one-sized fruit, of even quality and even colour, in a case and packing it so that it will carry without bruising, and, when opened up for sale, will show to the best advantage, is pretty certain of making good. On the other hand, the careless grower who sends inferior badly graded, or badly packed fruit is very likely to find when the returns for the sale of this fruit are to hand that after paying expenses there is little, if anything, left. The expense of marketing the fruit is practically the same in both cases.

Then why "spoil the ship for a ha'p'orth of tar" after you have gone to the expense of pruning, spraying, manuring, and cultivating your orchard? Why not try and get a maximum return for your labour by marketing your fruit properly? The packing of all kinds of fruit is a fairly simple matter, provided you will remember—

(1) That the fruit must be fully developed, but yet quite firm when gathered.

(2) That it must be handled like eggs, as a bruised fruit is a spoilt fruit, and, when packed with sound fruit, spoils them also.

(3) That only one-sized fruit, of an even degree of ripeness and colour, must be packed in a case.

(4) That the fruit must be so packed that it will not shift, for if it is loosely packed it will be so bruised when it reaches its destination that it will be of little value. At the same time, it must not be packed so tightly as to crush the fruit.

If these simple rules are borne in mind, growers will find that much of the blame they frequently attribute to the fruit merchants or middlemen is actually the result of their own lack of care. Fruit that opens up in the pink of condition sells itself, whereas any fruit that opens up indifferently is hard to sell on any except a bare market, and on a glutted market is either unsaleable or realises such a poor price that the grower is frequently out of pocket and would have been better off had he not attempted to market it.

If spraying with arsenate of lead and systematic bandaging has been properly carried out, there will be comparatively few codlin moths to destroy the later ripening pip fruits; but if these essential operations have been neglected or carelessly carried out a number of moths will hatch out and the eggs laid by them will turn to larvæ that will do much damage, in some cases even more than that caused by the first broods that attack the fruit as soon as it is formed. Where there is any likelihood, therefore, of a late crop of moths, spraying with arsenate of lead must be continued if the late crop of pip fruits is to be kept free from this serious pest.

Fruit fly must be systematically fought, and on no account must any fly-infected fruit be allowed to lie about on the ground and breed this pest, to do further damage to the later ripening fruits.

Citrus orchards will need to be kept well cultivated in the drier and warmer parts of the State, and, where necessary, the trees should be irrigated. If scale insects are present, the trees should be either sprayed or, better still, treated with hydrocyanic acid gas.

Western grapes are in full season, and if they are to be sent long distances by rail then they are all the better to be cut some hours before they are packed, as this tends to wilt the stems and keep the berries from falling off in transit. The fruit must be perfectly dry when packed, and should be as cool as possible. It must be firmly packed, as a slack-packed case always carries badly and the fruit opens up in a more or less bruised condition.

Farm Notes for January.

FIELD.—The main business of the field during this month will be ploughing and preparing the land for the potato and other future crops, and keeping all growing crops clean. Great care must be exercised in the selection of seed potatoes to ensure their not being affected by the Irish blight. Never allow weeds to seed. This may be unavoidable in the event of long-continued heavy rains, but every effort should be made to prevent the weeds coming to maturity. A little maize may still be sown for a late crop. Sow sorghum, imphee, Cape barley, vetches, panicum, teosinte, rye, and cowpeas. In some very early localities potatoes may be sown but there is considerable risk in sowing during this month and it may be looked upon merely as an experiment. Plant potatoes whole. Early-sown cotton will be in bloom.

On coastal and intercoastal scrub districts, where recently burnt-off scrub lands are ready for the reception of seed of summer-growing grasses, sowing may commence as soon as suitable weather is experienced. Much disappointment may be saved, and subsequent expenditure obviated, by ensuring that only good germinable grass seed is sown, of kinds and in quantities to suit local conditions, the circumstances being kept in mind that a good stand of grass is the principal factor in keeping down weeds and undergrowth.

In all districts where wheat, barley, oats, canary seed, and similar crops have recently been harvested, the practice of breaking up the surface soil on the cropped areas should invariably be adopted. Soil put into fit condition in this way will "trap" moisture and admit of the rains percolating into the subsoil, where the moisture necessary for the production of a succeeding crop can be held, provided attention is given to the maintenance of a surface mulch, and to the removal, by regular cultivation, of volunteer growths of all kinds. If not already seen to, all harvesting machinery should be put under cover, overhauled, and the woodwork painted where required.

Where maize and all summer-growing "hoed" crops are not too far advanced for the purpose, they should be kept in a well-cultivated condition with the horse hoe. Young maize and sorghum crops will derive much benefit by harrowing them, in the same direction as the rows are running, using light lever harrows with the tines set back at an angle to obviate dragging out of plants, but the work should not be done in the heat of the day.

Quick-maturing varieties of maize and sorghum may still be sown in the early part of the month in coastal areas where early frosts are not expected.

Succession sowings may be made of a number of quick-growing summer fodder crops—Sudan grass, Japanese and French millet, white panicum, and liberty millet (panicum). In favourable situations, both "grain" and "saccharine" sorghums may still be grown; also maize, for fodder purposes.

Fodder conservation should be the aim of everyone who derives a living from stock, particularly the dairyman; the present is an important period to plan cropping arrangements. Exclusive of the main crops for feeding-off (when fodder is suitable for this purpose), ample provision should be made for ensilage crops to be conserved in silo or stack. As natural and summer-growing artificial grasses may be expected to lose some of their succulence in autumn, and more of it in winter and early spring, the cropping ''lay-out'' to provide a continuity of succulent green fodder throughout the season calls for thorough and deep cultivation and the building up of the fertility and moisture-holding capacity of the soil. Planter's friend (sorghum) may be sown as a broadcast crop at the latter end of the month for cutting and feeding to cattle in the autumn and early winter. Strips of land should be prepared also for a succession sowing about the second week in February, and for winter-growing fodder crops.

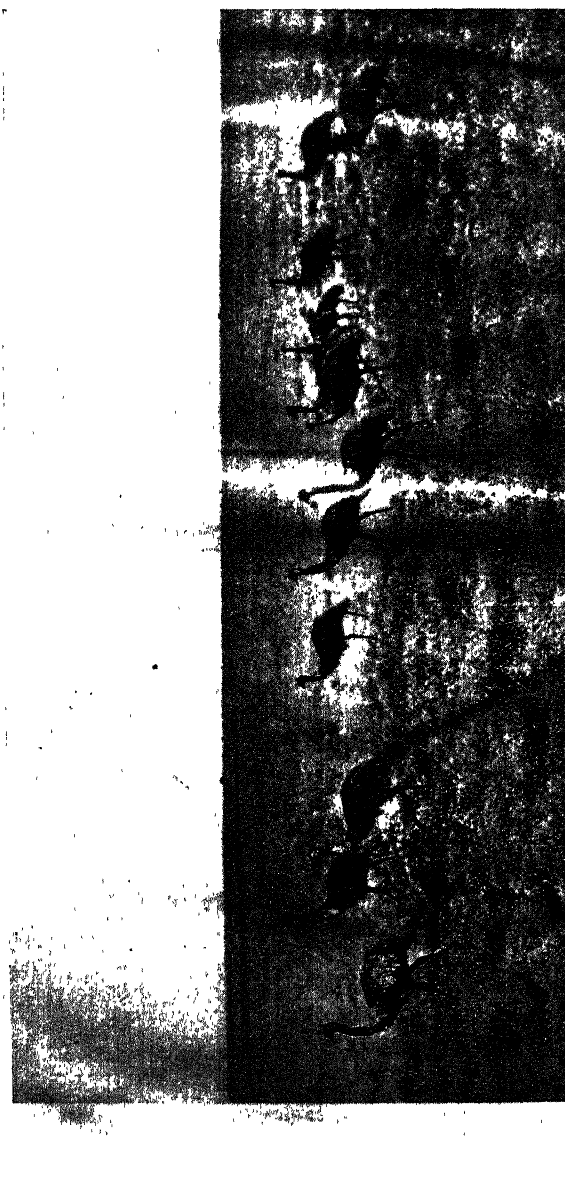

PLATE 330.—EMUS ON DOWNS COUNTRY, HUGHENDEN DISTRICT.

[Photo. by courtesy of Lands Department.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF OCTOBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING OCTOBER, 1934, AND 1933, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct..	No. of Years' Records.	Oct., 1934.	Oct., 1933.
North Coast.	In.		In.	In.
Atherton	0·92	33	0·91	1·86
Cairns	2·13	52	1·26	2·40
Cardwell	2·07	62	2·10	2·58
Cooktown	1·05	58	1·37	1·03
Herberton	0·99	48	0·58	1·86
Ingham	1·95	42	1·99	2·84
Innisfail	3·21	53	3·03	15·14
Mossman Mill ..	3·01	21	3·62	2·09
Townsville	1·38	63	0 10	1·20
Central Coast.				
Ayr	0·98	47	0·30	0·85
Bowen	1·05	63	0·44	2·02
Charters Towers ..	0·72	52	0·91	1·92
Mackay	1·66	63	3·65	1·45
Proserpine	1·72	31	0·89	2·76
St. Lawrence ..	1·77	63	2·06	4·66
South Coast.				
Biggenden	2·40	35	3·39	7·52
Bundaberg	2·11	51	2·89	4·48
Brisbane	2·54	83	1·34	3·82
Caboolture	2·52	47	1·94	4·36
Childers	2·69	39	3·87	8·18
Crohamhurst ..	3 29	41	..	5·99
Esk	2·53	47	1·76	1·77
Gayndah	2·40	63	3·26	4·87
Gympie	2·72	64	2·66	5·33
Kilkivan	2·62	55	3·55	3·76
Maryborough ..	2·78	63	3·88	8·28
Nambour	3·01	38	4·81	6·53
Nanango	2·25	52	1·47	1·45
Rockhampton ..	1·78	63	3·21	4·07
Woodford	2·56	47	1·60	3·72

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct..	No. of Years' Records.	Oct., 1934.	Oct., 1933.
Central Highlands.	In.		In.	In.
Clermont	1·32	63	2·09	2·15
Gindie	1·36	35	3·11	2·10
Springsure ..	1·64	65	2·74	2·69
Darling Downs.				
Dalby	2·08	64	1·45	5·73
Emu Vale ..	2·19	38	2·98	2·91
Hermitage ..	1·90	28	2·26	1·77
Jimbour	1·90	46	1·33	2·45
Miles	2·03	49	2·62	5·67
Stanthorpe	2·55	61	3·98	3·18
Toowoomba ..	2·55	62	3·12	2·67
Warwick	2·30	69	2·53	2·62
Maranoa.				
Roma	1·75	60	2·64	3·35
State Farms, &c.				
Bungeworgorai ..	1·44	20	2·75	3·09
Gatton College ..	1·99	35	1·95	1·56
Kairi	1·04	20	..	1·82
Mackay Sugar Experiment Station	1·39	37	2·14	1·29

J. H. HARTSHORN, Acting Divisional Meteorologist.

CLIMATOLOGICAL TABLE—OCTOBER, 1934.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means.		Shade Temperature. Extremes.				Rainfall.	
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·95	85	69	87	17,18,25	59	1	112	3
Herberton	..	79	59	85	17	50	2	58	2
Rockhampton	30·08	83	63	89	5, 28	55	5	321	9
Brisbane	30·13	76	59	85	28	50	23	134	8
Darling Downs.									
Dalby	30·10	79	53	87	23	37	2	145	7
Stanthorpe	..	69	47	78	7, 23	29	2	398	11
Toowoomba	..	71	52	78	28	37	2	312	8
Mid-Interior.									
Georgetown	29·94	96	70	99	9,13,14, 15, 16, 17, 18, 19, 20, 26	61	8, 18	16	2
Longreach	30·00	91	61	100	14	44	2	55	3
Mitchell	30·05	81	54	91	24	34	2, 3	326	7
Western.									
urketown	29·94	92	72	99	28	60	4	7	1
oulia	29·98	91	63	107	24	46	2	17	2
Thargomindah	30·02	83	59	99	23	43	2	117	6

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	December. 1934.		January. 1935.		MOONRISE. Dec., 1934.	MOONRISE. Jan., 1935.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	4·49	6·33	5·0	6·50	12·42	12·50
2	4·49	6·33	5·1	6·50	1·14	1·31
3	4·49	6·34	5·1	6·50	1 44	2·26
4	4·49	6·35	5·2	6·51	2·20	3·28
5	4 50	6·36	5·2	6·51	2·59	4·35
6	4·50	6·36	5·3	6·51	3·48	5·41
7	4·50	6·37	5·3	6·51	4·46	6·52
8	4·50	6·38	5·4	6·52	5·49	8·3
9	4·50	6·38	5·4	6·52	6·56	9·6
10	4·51	6·39	5·5	6·52	8·4	10·13
11	4·51	6·39	5·6	6·52	9·13	11 15
						p.m.
12	4·51	6·40	5·7	6·52	10·19	12·17
13	4·51	6·40	5·8	6·52	11·24	1·18
					p.m.	
14	4·52	6·41	5·9	6·51	12·24	2·20
15	4·52	6·41	5·10	6·51	1·26	3·18
16	4·52	6·42	5·10	6·51	2·26	4·14
17	4·52	6·43	5·11	6·51	3·27	5·5
18	4·53	6·44	5·12	6·51	4 28	5·54
19	4·53	6·44	5·13	6·51	5·28	6·37
20	4·53	6·45	5·14	6·50	6·22	7·14
21	4·54	6·45	5·15	6·50	7·12	7·47
22	4·54	6·46	5·16	6·50	7·59	8·18
23	4·55	6·46	5·17	6·50	8·39	8·44
24	4·55	6·47	5·18	6·50	9·13	9·13
25	4·56	6·47	5·18	6·49	9·46	9·42
26	4·56	6·48	5·19	6·49	10·15	10·13
27	4·57	6·48	5·20	6 48	10·43	10·46
28	4·58	6·49	5·21	6·48	11·10	11·26
29	4.59	6.49	5·22	6·47	11·40	a.m.
30	4·59	6·50	5·23	6 47	a.m.	12·12
31	5·0	6·50	5·24	6·46	12·13	1·6

Phases of the Moon, Occultations, &c.

7 Dec.,	● New Moon	3 25 a.m.
13 ,,	☾ First Quarter	8 52 p.m.
21 ,,	○ Full Moon	6 53 a.m.
29 ,,	☽ Last Quarter	12 8 p.m.

Perigee, 9th December, at 6 p.m.
Apogee, 25th December, at 7.36 p.m.

Mercury will be in conjunction with the Moon at 5 a.m. on the 6th, 1 hour 12 minutes after rising.

Venus will be in conjunction with the Moon at midday on the 7th, but being only about 4 degrees east of the Sun will be unobservable to amateurs.

Saturn will be in conjunction with the Moon on the 11th, an hour and a-half after setting. Earlier in the evening the crescent Moon and the planet will form an interesting spectacle apparently amongst the stars near the eastern border of Capricornus.

On the 31st Mercury will be in superior conjunction with the Sun, but being 1 degree 44 minutes southward will not get actually behind it. Mercury will then be at a distance of about 36 million miles beyond the Sun.

The Moon's path in December will be as follows:—Commencing at 8 p.m. on the 1st, it will be apparently amongst the stars of Virgo about 5 degrees south of the celestial equator; at midday on the 3rd it will be passing Spica, about 3 degrees south of it, and at 8 p.m. the waning Moon will be a little further to the south-east. About midday on the 4th it will pass into Libra and be in it till an early hour on the 6th; about 11 p.m. on the 7th it will pass into Sagittarius, but being new will be unobservable; about 8 a.m. on the 10th it will pass into Capricornus; at 11 p.m. on the 11th into Aquarius; at 9 p.m. on the 13th into Pisces; at 4 p.m. on the 16th into Aries; before noon on the 18th into Taurus; before midday on the 21st into Gemini; at 5 p.m. on the 23rd into Cancer; at 10 a.m. on the 25th into Leo, passing about 2 degrees south of Regulus at 10 a.m. on the 26th. It will pass again into Virgo at 4 p.m. on the 28th.

Mercury rises at 3.54 a.m. on 1st December and only 38 minutes before the Sun on the 15th.

Venus rises 12 minutes after the Sun and sets 14 minutes after it on the 1st; on the 15th it rises 26 minutes after the Sun and sets 29 minutes after it.

Mars rises at 1.4 a.m. and sets at 12.54 p.m. on the 1st; on the 15th it rises at 12.30 a.m. and sets at 12.31 p.m.

Jupiter rises at 3.15 a.m. and sets at 4.27 p.m. on the 1st; on the 15th it rises at 2.27 a.m. and sets at 3.45 p.m.

5 Jan.	● New Moon	3 20 p.m
12 ,,	☾ First Quarter	6 55 a.m.
20 ,,	○ Full Moon	1 44 a.m.
28 ,,	☽ Last Quarter	5 59 a.m.

Perigee, 6th January, at 9.42 p.m.
Apogee, 22nd January, at 8.0 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.